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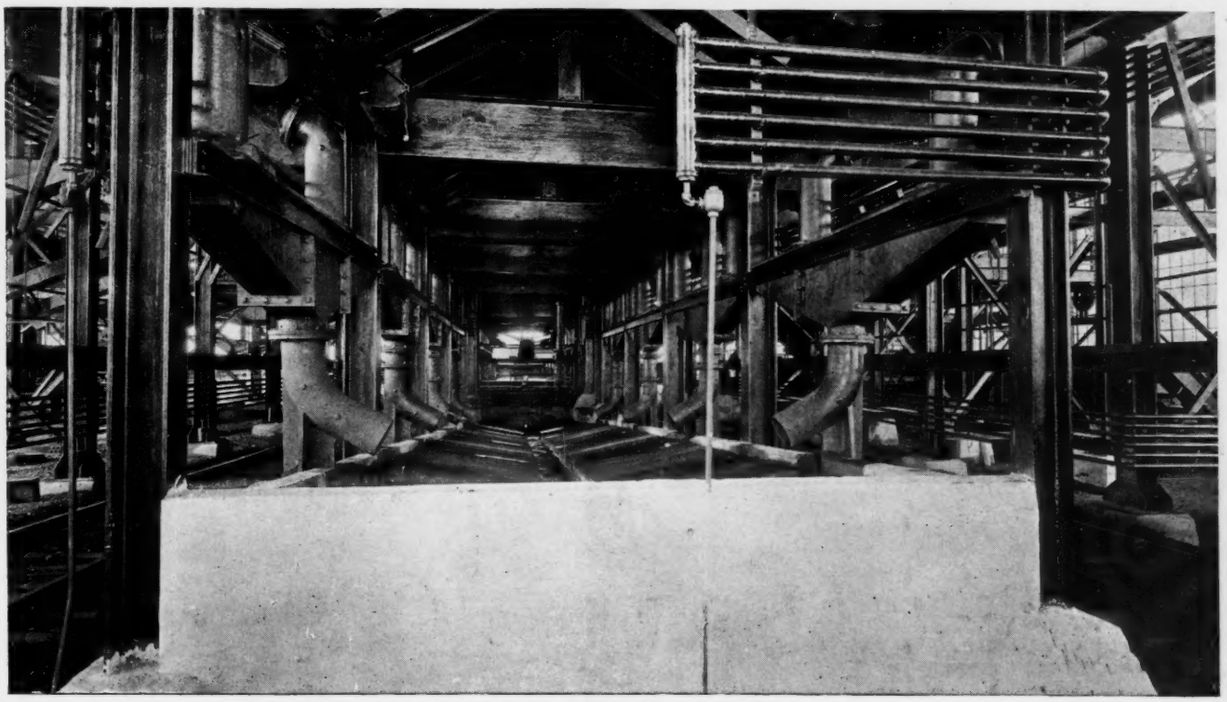
A Weekly Journal of the Mining and Mineral Industries

ENGINEERING AND MINING JOURNAL

McGraw-Hill Company, Inc.

September 24, 1921

Price 25 Cents Per Copy



The Ground Floor of a Coal Breaker in the Pennsylvania Anthracite District

The coal, after careful preparation, passes through chutes to the pockets, and in so doing much fine coal is formed by attrition and breakage. The view shows the mechanical arrangement by means of which the coal, screened immediately before discharge into the railroad cars, is collected and sent back by conveyor to breaker for treatment.

The Seventh National Exposition of Chemical Industries was held in New York City during the week of September 12. On pages 519 and 520 of this issue will be found short descriptions of the exhibits shown by engineering and manufacturing companies active in mining and metallurgical fields.

Joint meetings of the Society of Economic Geologists with the Institute at Wilkes-Barre were of considerable interest, both to coal and metal mining engineers attending. A report of these sessions, together with abstracts of some of the papers, is included in the article covering the meeting.

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Some Unique Bolivian Tungsten Deposits

By Frank L. Hess

Report of the Wilkes-Barre Meeting of the American Institute of Mining and Metallurgical Engineers

War Problems in Minerals

I—The War Minerals Committee, 1917-1918, by William Young Westervelt

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Biography of Stanly A. Easton

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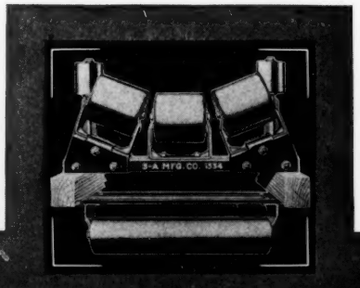

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Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
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Volume 112 **New York, September 24, 1921** *Number* 13

Should the Institute Increase?

WE REPEATEDLY FIND among those who are interested in the welfare of the Institute and devoted to its progress, the feeling that the membership should increase, until it is not ten thousand, but twelve, fifteen, twenty thousand; that this is the index of health and the measure of prosperity, and something to be pushed most assiduously.

We wonder why. For yourself as a member of the Institute, will it be of more value to you, can you through it be of greater service, if it has fifteen thousand than if it has ten? We are afraid we miss the point. We remember a boy who gloried in the population of cities; many point with pride to the fact that New York is larger than London; and not a few refer, with the self-satisfaction of having in some way been personally meritorious, to the "hundred millions" of the United States. Yet China has four hundred million, and India teems with the merit of population, if there be any merit there. Athens, as we remember, was remarkable neither for acreage nor population; nor were the passengers on the "Mayflower" more than a hundred and twenty-one.

The ideal of an increasingly large poll of Institute members does not, it seems to us, reflect any desire on the part of the present membership; nor does it offer any hope of correspondingly increased efficiency or results. It must be, then, that the ambition originates in the management, in a desire to make a good showing for their stewardship, and, very likely, in part in the plain need of additional funds to meet the Institute overhead expenses. If it is the desire to make a showing, then we submit the query whether such a showing of increased membership really means much one way or the other; if the drive is for ever-increasing funds, then we believe such a motive is not worthy of a technical society. Let the membership be determined entirely by other than monetary considerations; then fit the overhead expenses to the funds actually in hand. If the society can only keep a jump or two ahead of the sheriff by a constant proselyting with a view to more dues, then the direction of the funds is too ambitious, and the main object of the society and its directors—which is scientific and technical—becomes more and more distorted into that of a commercial organization or a business plant.

The Production of Coal

METAL MINERS are likely to consider the production of coal a dissociated industry, a thing apart, and one which has little in common with the mining or preparation of metals. Little thought is given to its why and wherefore, excepting in general discussions on the efficiency that its use may or may not produce in the boiler room at the mine or smelter. They are apt to assume a blasé air when the subject is mentioned—"Oh, yes; there is probably some work connected with its production, but not at all comparable with our own mining, milling, and metallurgical problems."

But long ago we all learned that the moon was not made of green cheese, and from time to time we find that certain other cherished ideas are more or less mistaken.

Actually, in a period of great depression, such as the metal mining industries are now experiencing, a visit to the coal districts is somewhat of an inspiration, and it was rather with a feeling of envy that we viewed the activities that are present on every side. The towns, mines, and plants have a busy appearance; there are no signs of idleness, and everywhere there is the expression of confidence that comes with the knowledge that conditions are all that they should be.

We expected that some advances had been made in the mining and preparation of coal, but it was somewhat of a surprise when we were given the opportunity to view the operation of the latest thing in the way of a modern breaker, and be initiated into the intricacies of anthracite coal preparation.

The Marvine breaker of the Hudson Coal Co., near Scranton, which was visited by the Institute the morning of Sept. 13, is the newest and most modern plant in the anthracite district. Here one may see operations of conveying, screening, shaking, slushing, jigging, classifying, and tabling conducted in a manner that is not comparable to the practice in the metal field. In metal mining, no attempt is made to prevent the breakage of ore in transit through the mill; in fact, its disintegration is encouraged as much as possible. But with coal the rule is opposite, and a maintenance of continual flowage of the coal is necessary to prevent breakage. So it is that an elaborate system of spirals and curves confront the coal at every turn and prevent unnecessary shocks. The entire operation is one of intense interest, from the time the coal leaves the head house until the final sizes are reached.

The Tacna-Arica Problem

MINERAL NITRATES and copper in South America bid fair to influence world politics quite in the same way as iron and potash in France and Germany, or coal and zinc in Germany and Poland. The German-Polish contest for great coal and zinc reserves goes in the world by the name of Upper Silesia; the great iron-potash reserves contested for by France and Germany have long embroiled the world in war and devastation under the name of Alsace-Lorraine. The South American nitrates contested for by Chile and Bolivia go under the name of Tacna-Arica, the names of the two provinces or departments inclosing the disputed territory.

This territory, before the war between Bolivia, Peru, and Chile, was considered Peruvian, but was held of little value, and after the war it was turned over to Chile for ten years, with the agreement that at the end of that

period a plebiscite, or vote of the population, should determine whether it should thenceforth be Chilean or Peruvian. The same foolish method of determination, that of a plebiscite, it will be remembered, was fixed upon by the Allied Council for the disposition of the coal and zinc which goes by the name of Upper Silesia; but when it comes to the actual working out of this infantile expedient it has not been found to be satisfactory, and still remains undetermined.

The same unsatisfactoriness developed in the plan for the disposal of Tacna-Arica. Valuable nitrates were discovered in the province and copper mines were opened; but in the meantime Chile had already apparently disposed of her possible ownership by agreeing that if she obtained, by the plebiscite, possession of Tacna-Arica, she would sell it to Bolivia so that that land-locked country might have an outlet to the Pacific through the port of Arica. Mark, then, how the discovery of valuable minerals changed all this. Chile becomes reluctant to give up that possession which is nine points of the law, and quite rivals the later example of the Supreme Council in the Upper Silesian matter in her failure to carry out a definitive plebiscite.

Later Bolivia entered into a treaty with Chile whereby Chile agreed to give the former country free access to the sea through certain of her ports. Argentina meanwhile has become mixed up in this mess, through negotiations with Bolivia. Here is then a pretty kettle of fish, or, better, cauldron of nitrates. Bolivia has appealed to the League of Nations to settle the question, but Chile falls back on the Monroe Doctrine and denies the League right to interfere in matters in the Western Hemisphere. It will be remembered that lately Panama appealed to the League in the Panama-Costa Rica controversy, over the decision of the American State Department as referee, but that the State Department, to put it colloquially, "sat down hard" on Panama.

But the fact that Argentina withdrew from the League meetings spectacularly last year, and that this year eight Latin-American countries are unrepresented in its meetings, as is the United States, indicates unwillingness of the Western Hemisphere nations to submit their troubles to the existing World League, and a tendency of not only the United States but Latin America to conceive of the Monroe Doctrine as a right prior to the World War developments.

Mexico Beginning To Look Attractive

MANY PARTS OF MEXICO are not undesirable places in which to pass a winter, and it is likely that many mining men now unemployed will feel the urge to go there rather than pass the coming season further north in idleness. Conditions continue to improve in our southern neighbor, at least as far as external appearances go, and early recognition of the Obregon government seems assured. Such recognition will go far toward renewing the confidence of Americans who have not kept in touch with what was going on in that country, but who have unjustly supposed that it was overrun with desperadoes and that no mining claim was safe. There are probably few parts of Mexico now where justice cannot be obtained. Increased mineral development of the country will mean greater prosperity for the inhabitants, which will in turn result in more confidence in the government and make for increasingly stable conditions.

More activity has recently been reported at the Mexican smelters, and representatives of large interests, as well as numerous individuals, are beginning to pick up desirable properties, both new prospects and old mines which for one reason or another have been abandoned. There are many desirable small mines which a group with a little capital can make into profitable producers by building a 50- or 100-ton mill and providing simple mine equipment.

Mexico is fortunate in being particularly rich in those metals which it is most profitable to mine at present—silver, lead, and gold. Silver and lead are both above pre-war prices, with no apparent reason why prices should go lower. Gold production costs are coming down, and the mining and extraction of that metal is becoming a profitable operation.

A note of warning must be sounded to those without capital and who have never been in Mexico. They are likely to find employment there as difficult to secure as at home, and there are no gold nuggets lying untouched in the stream-beds, as some newspaper reports would indicate. The country has been pretty thoroughly prospected for several hundred years. The opportunities are more for the man who has the necessary capital and energy to develop known deposits. He who has no knowledge of the country, its language or customs should beware. Opportunities for mining are not to be found everywhere, and success will tend to concentrate on those who know the ropes. It is difficult, in many cases, to determine present ownership.

The United States citizen must not forget that he is a foreigner in Mexico, and not always a welcome one either; and he must be careful of his conduct and bearing if he is to win the confidence and respect of those with whom he comes in contact.

The Mine-Shaft Telescope

NEWS COMES to us through the newspapers that a deep mine shaft in the high altitudes of Chile is to be used as the barrel of a great telescope through which to get snapshot photographs of Mars, from an apparent distance of a mile and a half. In this way "B. McAfee, American scientist and collaborator with David Todd, the well-known American astronomer," expects to prove that life exists on Mars, the planet whose straight line markings, netting over its globe, have been surmised by Professor Lowell and others to be irrigation canals, spreading over the arid equatorial and intermediate zones the water derived from the annual melting of the polar ice-caps, which are plainly visible with the present telescopes.

It is gratifying that some use has been found for a mine shaft which has failed to encounter ore or from which all ore has been extracted. The painful jocularity of the suggestion that the expensive mine shaft be cut up and sold for post-holes may now be replaced by some novel pleasantries.

It makes little difference, of course, as a source for pleasantries, that the report is probably misleading. Already, a Harvard professor of astronomy has declared it "bunk; absolutely bunk." We have, indeed, come to know beforehand that mining news which we read in the newspapers is bunk. Said newspapers, even those which boast of printing "nothing but the truth" or "all the news that's fit to print," have an uncanny instinct for the unreliable when they touch on mining, which is a problem in psychology, and, therefore, we will not pursue it further here.

Governmental Research Through Industrial Laboratories

THE OLD STORY of Mohammed and the mountain has many applications, and the latest is that in which the U. S. Bureau of Mines stands for Mohammed, while the mountain is represented by appropriations for technical research in non-metallic minerals. When, through what may be mildly termed Congressional reserve, instead of a mountain, an appropriation that might be compared with only a fair sized mole hill came at the urgent call of the Bureau, that institution, like the renowned Mohammed, went out to find the obdurate mountain. In other words, when insufficient appropriations were available to conduct adequate laboratory investigations, the Bureau sought some means of conducting laboratory tests without the aid of appropriations. This it accomplished by enlisting the service of various industrial laboratories, where experiments were conducted under Bureau direction.

A pressing problem in the non-metallic field is the development of wider uses for the heavy proportion of waste at slate quarries, a waste that reaches 50 to 90 per cent of gross production. At the Bureau's request about forty-five manufacturers of such products as road asphalt, rubber, plastic roofing, flooring, and ceramics agreed to test pulverized waste slate as a constituent of their products. The Bureau supplied the samples of slate for testing purposes, and reports from the various laboratories were submitted to the Bureau, where the results thus independently obtained were carefully analyzed and summarized. It appears from the conclusions reached that a greatly enlarged field of useful application of a waste product has been discovered.

The Bureau of Mines is not desirous that the success of this mode of investigation should encourage Congress to still further reduce appropriations, for the method has serious limitations. Many technical problems must be solved directly by Bureau men in their own laboratories, and under their direct supervision. Without adequate appropriations such problems may not be undertaken. It would seem, however, that as an alternative method adopted through necessity, for certain types of problems, the work done by industrial laboratories under Bureau direction has a number of points in its favor. In the first place the experiments are conducted by practical men under practical working conditions, and the products are tried out on an industrial basis. If information of advantage to the industry is evolved through these experiments, at least a part of the industry knows of it at first hand, and any resulting innovations are comparatively easy to introduce.

An Expanding News Service

FOR THE LAST YEAR a weekly London letter has been a feature of our news pages that has greatly broadened their scope. In the last issue we published a similar letter from Johannesburg, which we hope will appear hereafter as regularly as that from London. Thus the *Engineering and Mining Journal*, through its correspondents in Canada, London, Australia, and South Africa, as well as at home, is presenting to its readers mining news from all the English-speaking world. "The world is our parish," as John Wesley said, and through the medium of the international news agency that we recently mentioned, and through our correspondents in Mexico, South America, and Continental Europe, whose number is steadily increasing, we hope to make this service increasingly valuable and interesting.

Our news columns are not conducted with the idea of toadying to subscribers, actual or hoped for, by publishing something, whether fact or fiction, about a district or properties in which they may be financially interested. Occasionally a letter is received from someone who apparently does not understand our position in this matter, but such occurrences are rare. To pursue any such policy would be fatal to the reputation of this or any other paper. Nothing is more sickening from a journalistic point of view than a paper that makes a business of publishing "write-ups" and puffs for value received, and the editor who pursues such a course is deliberately misleading his readers.

We believe that the readers of the *Engineering and Mining Journal* are interested in the progress of events in the mining world. Occasionally one meets a specialist who is so devoted to his specialty that he has neither time nor thought for anything else. Such a man probably neglects his wife. His horizon at least is very narrow, and it is safe to bet that he has little interest in news of any kind save that concerning his specialty.

Sometimes we have met others who denied all interest in mining news. These were generally men in minor positions whose attention was concentrated on the details of surveying, assaying, or some other branch of work for a large company. These men might profit, if they only knew it, if they would keep posted on the current news of the industry. They might, possibly, even get indirectly a better position. At any rate they would be better informed as to the industrial conditions which vitally affect them as much as any one else and which will undoubtedly have a bearing on their future.

Broadly speaking, it is our experience and belief that the bigger a man is the greater his interest will be in the current news of the industry. It has for him a significance that the man of smaller calibre has perhaps not yet learned to appreciate. To have this value, news must be prompt, truthful, and exact, and the wider its scope the more valuable it will be.

Desert Ranges in Mexico

A WELCOME ADDITION to our knowledge of the economic geology of Mexico is the little paper of Charles Laurence Baker, presented at the Wilkes-Barre meeting of the American Institute of Mining and Metallurgical Engineers, on the Catorce district in the State of San Luis Potosi. Catorce is an old and important silver camp of Mexico, concerning which we have had too little knowledge. Mr. Baker does not fall into the usual scholastic blunder of describing the mountain range at Catorce as a range due to block faulting, although the Sierra de Catorce is one of the desert ranges which, at least on the American side of the border, have been sweepingly condemned to this origin, regardless of their individual geological structure. But Mr. Baker observantly explains: "As is usual in desert regions, the heavy-bedded limestones are the most resistant to erosive forces. Folded into anticlines they form the mountain ranges; and the intermontane valleys and basins, originally carved out of less resistant shales, clays, marls and sandstones, are covered by debris, forming a mantle with surface gradually rising upwards toward the hills." A lucid, true and welcome description of the desert ranges of northern Mexico, as contrasted with the usual twaddle about block ridges, and the chatter of *horst* and *graben*.

WHAT OTHERS THINK

Obeying an Impulse

I have only just read your issue of Aug. 6, so that this communication will be late. But I cannot resist the impulse to comment on Mr. Borcherdt's comparative views of you and the *National Geographic*. Your editorial brought me a great contentment, the contentment that comes when someone else puts into effective words what one has always felt and wanted to say but did not know how to. And how utterly Mr. Borcherdt misses the point of what you had to say!

I like the *National Geographic*—so far as it goes. I take it, and my children thoroughly enjoy it. It does no harm, and may do some good. But the point is that to obtain its enormous circulation and conduct its praiseworthy semi-scientific researches it has had to resort to what may justly be termed a cheap game of flim-flam and bunk.

Of course it has seventy subscribers to your one. What does that mean? Is it not that seventy people out of seventy-one prefer amusement to instruction; and is that not about the ratio that anyone of judgment would estimate for our country at large? If you wanted money, wouldn't you rather own the *Saturday Evening Post* than the *Atlantic;* wouldn't you rather be Mr. Lasky and insure your life for $5,000,000, than a college professor with a chance at a Carnegie pension? I should say that just about one person in seventy-one cares anything about finding out the real truth—and he is pretty sure to be an engineer.

One cannot dĕny that the *Geographic* is an outstanding success in the direction it has chosen. But I am not so sure that Lincoln was right. At least, I fear that you can fool a majority of the people most of the time.

Carmel, Cal. L. O. KELLOGG.

The Original Alchemist Challenged

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Josiah edward SUSPurr, EDITOR
NEW york City;

I were greetly surprized to read in a resent volumn of ENGINering & MIning journal why sush a edicated maguzine as is yourn will pay so close & valyble attentions to a artikle by ignoranting and un-edicated prospecktors as my Ole frend joSua HARBREN from Lords Burg. my persenel nowlege consarning mister HARbren comprizes facts as demonstraights he aint abul to even spel correckly.;$ 4 years coming this winteri spent 2 months with H arbrin with him tryen to learn me chemicalistry.he was a Rank failyour. WHAts more iI Claims he STILL IS?

THe ignoranse of hisen is surmounted by yourown impudance in claiming him as THE oRIGINAL ALchemist".Such is not facts as i no.not claiming to be no grate litter writer my self i still admits I am somewhat of a chemistis.being red up on all late pulmagations of sceince & your valuble maguzine.NO one aint yet proven to me as yet they possesses the un-dis-puted power & ability of making gold or platnum from bras & iron fileings,I stil claims thier aint no such man in these parts.

when i red your artikle I at once tuck the matter up regardening this Knowledge with mister ALbert KoLer, who is watchman of the IMPERIAL MINE at that point & to my own knowledge & his own admissun one of the best chemistis and mining experts i knows of.he has dramatically re-footed the entire ellegation.both of us being readers of your valuble maguzine we constitutes ourselfs a chapter and holds a meeting of THE AMERICAN inStITUTE of MINING & METELLOGOCAL eNIGINERS cundemming this knowledge.(by the way let me mention that as yet eigh er of us has received our surtificats uniforms or badges and we have benn reading your valuble maguzine most on to a year nowO)

I cares nohing about mr Harbrens *secret*(NOT sekret) formulelet being as his hole thery is non-practikal.elusive & has no bearings ins sceince.Your valuble maguzine will do well to avoid publication & indorsemeants of such in-sceintific persons as aassume on the public by getting there faulse dockrines pulmugated in highly refuted and valuble sceintific maguzines as yourn.i aint written much in my day but if your valuble maguzine is to continue mis-forming the publik and loaning yourselfs to the properganda of un-ethercal principlas of sceince such as the heritical assumption of mister Josua HarBren(AN ignorunt NO-NUTHIN) i shall sereciously consider the publication of our own periododdical here.

I,mister Koler,and myselfs will expect a apoligy to the sceintific world in the next vlumn of your valuble maguzine.

respectivly
ADOLPH GROHEIGHER

Concerning the Licensing of Engineers

Your patience is remarkable and your magnanimity excessive in reading over and printing the outpourings of our friend from Arizona. I had the pleasure, as a consequence of the above-mentioned eruption, to read again your admirable comment on the licensing of engineers in the July 30 issue. There is nothing in the licensing idea. In reading the criticism of that editorial by F. B. Smith in the *Journal* of Aug. 27 I failed to discover any new point—or old one, for that matter. In fact, all the reasonable arguments generally put forward in favor of licensing the engineers were successfully refuted in your treatment of the question. I would suggest that your communicant from Arizona read his article as well as the one to which he objects once again and inform us wherein he has contributed to the discussion of the licensing of engineers or to the decorum of technical writing. DJEVAD EYOUB.

Brooklyn, N. Y.

American Institute of Mining and Metallurgical Engineers Meets at Wilkes-Barre to Celebrate Fiftieth Anniversary

Mining Engineers Visit Wyoming, Lehigh, and Southern Regions of Pennsylvania Anthracite District—Visitors Inspect Modern Coal Breaker—Interesting Technical Sessions Cover Coal Mining and Preparation, and Include Joint Meeting With Society of Economic Geologists — Summary of Papers and Discussions

THE One Hundred and Twenty-Fourth Meeting of the American Institute of Mining and Metallurgical Engineers opened on Sept. 12 at Wilkes-Barre, Pa. It seems fitting that this gathering, which marks the fiftieth anniversary of the founding of the organization, should have been held at Wilkes-Barre, where, on May 16, 1871, the first meeting was held. In consideration of this fact, it might have been expected that the attendance would have been larger, but taking into account the dullness that is now prevalent in the metal-mining field, and the fact that coal mining has but a limited interest for the metal-mining members, the showing was an excellent one. As it was, the registration for the first day was light, but this improved rapidly, and the final figures reached about 500 toward the end of the meeting.

Certainly no effort was spared by those who had the meeting in charge to make the stay of the visitors a pleasant one, and the arrangements for each part of the program were carried out in detail. It was an engineering job, planned by engineers and executed with a precision that is typical of Institute meetings. The absolute lack of confusion, the orderly regularity and the dispatch with which each affair moved, was admirable. The New York contingent are, of course, familiar with the "Follow the Green Line" idea, and necessarily require prompting from force of habit, but it was noticeable that comments on the "arrow" plan, used by the committee, were also made by those from other sections.

Headquarters were at the Irem Temple, and here most of the technical sessions and the dinner and dance were held. Monday morning was given over entirely to registration.

The programs, issued by the local committee, were most attractive and served as a complete guide throughout the entire meeting. These were provided with an attractive panneled cover—white and terra cotta—with suitable lettering in black. We were informed by one of the committee that the color scheme used represented the coal (black), the white ash (white), and the red ash (terra cotta) of the district. The most valuable feature of this souvenir was the arrangement (Blue Book fashion) of the three tours made through the district. By means of this coal-district Baedeker, with one eye on the speedometer and the Blue Book, and the other one on the passing landscape, it was possible for each member to obtain an excellent idea of the nomenclature of the points of interest.

ENTERTAINMENT OF THE LADIES

A special program was arranged for the entertainment of the visiting ladies by a committee of which Mrs. R. V. Norris was chairman. This included, together with the regular program—excepting the technical sessions—a number of special automobile trips and functions. On Monday afternoon the visitors were taken to the Wyoming Country Club, where tea was served. Tuesday, following the luncheon at the International Correspondence Schools, Scranton, a visit was made to the Woman's Institute of Domestic Arts and Sciences of the I. C. S., and this was followed by an automobile drive by the way of Elmhurst Boulevard around Lake Scranton and to the Scranton Country Club, where tea was served. At a meeting held Tuesday evening at the Irem Temple, the suggestion of forming an Anthracite Section of the Woman's Auxiliary of the Institute was made, but this was not formally acted upon, although it was decided by the local women to take the matter under consideration. Wednesday morning a visit was made to the Duplan Silk Mills, at Dorranceton.

"THE ASHLEY PLANES"

The technical meetings began Monday afternoon. R. V. Norris, chairman of the general committee, introduced W. J. Richards as chairman of the first coal session. H. D. Kynor, of the Hudson Coal Co., presented an interesting paper, "Mechanical Mining of Anthracite," in abstract, and made use of several cross-section and plan diagrams to show the scraper method and the long-wall method with face conveyor as used in the anthracite district. In mechanical mining, in this district, as contrasted to hand methods of mining, use is made of undercutting machines, jackhammer-type drills, long-wall conveyors, mechanical scrapers, short-wall and long-wall machines, and shoveling machines. The advantages of mechanical mining, as applied to thin veins, are much greater in the case of thick veins. The paper was discussed by Cadwallader Evans, Sidney Jennings, W. J. Richards, and George S. Rice.

Secretary Sharpless read the paper "The Ashley Planes," by C. H. Stein. These planes are operated by the Central Railroad of New Jersey, and consist of a series of three inclines or planes up which the coal cars are raised from Ashley to Solomon's Gap, a total rise of 1,026 ft. The object of the planes is to overcome the small tonnage movement at low speed over heavy main-line grades for a distance of twelve miles by a rapid movement of large tonnage over a distance of only two and one-half miles over grades in excess of those upon which a locomotive could operate. This is accomplished by installing hoisting engines of large capacity at the head of each plane, which, by means of large cables, haul the cars to the objective point. The loaded cars are taken from the receiving yard, close to the foot of the planes, in trains of six, and placed over a truck pit at the foot of plane No. 3. The footman at this point, by means of a bell, signals the engineman at the head of the plane, who applies his power and

draws a truck, or "barney," from the truck pit behind the cars. As soon as the engineman feels the "barney" go against the cars he speeds up his engine and the cars start their ascent of the plane.

On each plane there are two parallel tracks and at the foot of each there are two parallel truck pits. The cable from one "barney" passes up the plane over sheaves about 22 ft. apart, then three times around drums 20 ft. in diameter, and out through the bottom of the power house over a large sheave, which returns the cable to a "barney" on the parallel track. As a result, when one "barney" ascends, drawing up the cars, the "barney" at the head of the plane descends, drops into the truck pit, passes under the six loaded cars that have been placed by the engine, and is ready for its ascent. When the cars reach the top of No. 3, the train is cut in two, as only three cars at a time are drawn up planes Nos. 2 and 1. The cars may be drawn up the planes at speeds of from twelve to thirty miles per hour.

The most interesting feature of this plant is the manner in which the "barney" passes into the truck pit, underneath the cars, and then out of it again behind the cars. This is accomplished by an ingenious arrangement of the wheels of the "barney" and of the track devices. Each wheel has its own axle, which slides in its own sleeve independently of the others. The "barney" weighs seven tons. Discussions of this paper were given by Douglas Bunting, Graham Bright, Mr. Jennings, Mr. Norris, C. H. Strange, and Edwin Ludow.

"ANTHRACOAL"

Donald Markle presented a paper, "Anthracoal: A New Domestic and Metallurgical Fuel," in which he detailed the composition, properties, and manufacture of the mixture, known as "anthracoal," and composed of small particles of anthracite coal and a matrix of practically pure carbon, formed from the distillation of coal-tar pitch or other suitable bitumen. It is a hard, dense, homogeneous mass, with a silvery luster, and in color varies from silvery to grayish black. When pushed from the oven, it develops only partly the finger-like structure of coke; but, unlike coke, it has a tendency to remain in blocky masses. When struck with a hammer or passed through crushing rolls, it breaks with an irregular fracture, similar to anthracite, but with very little fines. Owing to its density, "anthracoal" is harder, tougher, and stronger than coke. Discussions of this paper were give by Mr. Ludlow, Charles Dorrance, William Griffith, E. M. Chance, E. W. Parker, George H. Ashley, and Mr. Rice.

John Griffen, manager of the anthracite territory for the Dorr Co., presented "The Slush Problem in Anthracite Preparation." This paper deals with coal washing and the disposal of silt or slush which results from the mixture of coal, slate, pyrite, and clay with water. The present methods for disposing of slush in dams, as mine fillings, or delivered to settling tanks; the types of equipment used, and the utilization of the fine coal recovered from breaker slush were outlined.

In the evening a second coal session was held. E. W. Parker, director of the Anthracite Bureau of Information at Philadelphia, gave a general description of the anthracite fields and illustrated his talk with lantern slides showing cross-sections and the extent of the various fields comprising the anthracite region, together with diagrams showing the methods of mining. Howard N. Eavenson, in presenting his paper, "The Lynch Plant of the United States Coal & Coke Co.," made use of several lantern slides and gave a very complete talk on the work which has been done and is now being conducted at this company's plant in Harlan County, Ky. An elaborate system of housing has been established, together with the necessary plant buildings and equipment, and the undertaking represents a modern advance in industrial development. The meeting of the Metal Section, originally planned for Monday evening, was not held.

THE AUTO TRIP TO SCRANTON

Tuesday morning the visitors left headquarters by automobile for a trip[1] through part of the Wyoming Valley to Scranton. The route taken parallels the Susquehanna River to a point about opposite Pittston, and then swings over to the east side of the Lackawanna River. An excellent opportunity was afforded to view the outcrops of several of the coal beds, other interesting geologic features, and the numerous collieries and breakers. A stop was made at the Marvine colliery of the Hudson Coal Co., and here the visitors inspected the several buildings and equipment. In the office a number of charts, showing the placement of men, mules, and motors in the various workings of the mine, were shown; also cross-sections, maps, and other data. Another interesting exhibit was a model showing the operation of the breaker at that plant.

An outstanding feature of the entire meeting was the inspection of the 5,000-ton steel breaker at the Marvine plant. We are indebted to the Hudson Coal Co. for the following complete description:

A scraper conveyor is used to convey coal from No. 2 shaft head house to the inclined conveyors leading into the breaker. This conveyor line is 800 ft. long, and is underground, a concrete tunnel having been built to allow for its passage from No. 2 shaft to its point of dumping; the conveyor passing under the center of breaker, at which point all material which has to reenter the breaker (such as lip screenings, product from slate shakers and slush shakers, and also egg rolls when in use) enters the conveyor line and goes back into the breaker. Run-of-mine coal is dumped from railroad cars into this conveyor line, and the coal fed into the conveyor by means of an automatic feed shaker. The wet method of preparation is used and the breaker itself is as nearly fireproof as is practicable.

Another feature is the crushing of the coal on the ground before it is taken into the breaker. The only crushing being done in the breaker is that of grate or broken coal when there is no market for this size. This crushing of the coal on the ground has two added features, namely, the elimination of heavy crushers at the top of the breaker, which causes heavy strain on the structure, due not only to the heavy crushing rolls, but also the vibration caused by the heavy bull shakers, and also a considerable reduction in the height of the breaker which would be necessary if crushing was done at the top of the breaker.

There are four sets of double-deck shakers at the top of the breaker, which size steamboat and broken sizes. Two sets of No. 2 rolls, size 30 in. x 36 in., are so situated in front of these shakers as to break the product from these shakers to egg and smaller sizes. Broken coal from the bottom deck of these shakers can be either

[1] A résumé of the three tours planned by the local committee appeared in *Engineering and Mining Journal* of Sept. 10.

sent to jigs and prepared for market, or else sent to rolls. Four sets of shakers sizing from egg to birdseye are located below these shakers. Each battery of jigs has its own slate shaker for removal of breakage from the slate. There are also three slush shakers, two for removal of slushings from the jigs, and one for reclaiming all slushings from lip screenings.

Forty-four Delaware jigs are in this breaker. This jig is similar in its action to the Lehigh jig, being of the piston type. It differs, however, in that its coal compartment is one foot longer, allowing for an increase in depth of coal bed carried in the jig, and also giving the jig greater capacity. Another important feature is the coal-lifting plunger, which removes the coal from the jig with a minimum amount of breakage, and does away with the coal-discharge conveyors as used on the Lehigh Valley jigs. These jigs have a jigging capacity of from twenty-five to thirty tons per hour. The jig is the invention of S. V. Tench, superintendent of preparation.

A Dorr separator plant is located on the northerly side of the intake conveyor lines. This plant contains a 34-ft. diameter Dorr thickener, which will bypass all water and fines which pass through a 100-mesh screen. The thickened material will pass over eight concentrating tables to reduce the ash content in the silt, and silt will then be treated in six Dorr separators for the removal of water, after which the product will be conveyed to a storage pile.

The breaker is electrically operated, the main switch and control boards being located above jig floor. There are eleven motors, separately controlled, which operate the various mechanical units, such as jigs, shakers, rolls, and other apparatus. The breaker is so designed that one-half of the plant can operate independently of the other half, thus insuring steady operation when a breakdown or other trouble occurs.

Water is supplied from the Lackawanna River by means of electrically driven pumps.

Correspondence Schools Visited

At noon the International Correspondence Schools at Scranton were reached, and there the party was tendered a luncheon in the dining room maintained by the I. C. S. for the school's employees.

Following an inspection of the various departments of the International Correspondence Schools, two technical sessions were held. At the coal session, which was held in the auditorium of the I. C. S., William Griffith presided. Douglas Bunting, general superintendent of the Lehigh & Wilkes-Barre Coal Co., read a paper on mine fires in the anthracite regions, and the following men took part in the discussions: H. H. Otto, who read a paper by J. D. Warriner on the Panther Creek Valley fire; E. M. Chance, Edwin Ludlow, J. A. C. Ritson, George S. Rice, R. D. Hall, and R. V. Norris.

The Session on "Americanization"

The Americanization session was held in the auditorium of the Scranton Y. M. C. A., and was presided over by Arthur Notman, in the absence of Robert Linton. E. E. Bach, in his paper, "Americanization in Mining Communities of Pennsylvania," outlined the state program of Americanization as contemplated by the Department of Public Instruction. This was followed by "Americanization of Foreign Labor in the Pennsylvania Anthracite Fields," by F. E. Zerbey. S. C. Weber in his paper, "Americanization—What Is It?" made a plea for the public school as the preparation for citizenship. In speaking of the Americanization activities of the Y. M. C. A. in industrial centers, Dr. Peter Roberts referred to the work as the "blending of the best that the world knows," and told of the excellent strides that have been made in the upbuilding of citizenry. The teaching of English is the first step, said Dr. Roberts; then naturalization, lectures, and entertainment. The remaining papers that were scheduled for this meeting had to be omitted on account of the lack of time.

Upon the completion of the sessions, members embarked in the cars parked at the International Correspondence Schools and made the return trip to Wilkes-Barre.

A technical session, which was presided over by R. A. Quinn, was held at Irem Temple in the evening. H. A. Reichenback read J. M. Fuller's paper, "The Application of Pulverized Coal to Boilers," and stated that, although experiments had been made in the use of this type of fuel for the last twenty years, it was not until 1916 that the first successful commercial application was made. The various steps in the preparation of the coal, from the raw material to the pulverized state, were shown by means of slides. The chairman emphasized the importance of the paper, stating that the subject was of the greatest interest to anthracite operators, and there was considerable discussion by George S. Rice, H. M. Chance, George H. Ashley, C. M. Latz, T. E. Fisher, and others.

A paper by Dever C. Ashmeade, "Advances in the Preparation of Anthracite," which was scheduled for the meeting, was omitted, as was also J. L. Bruce's paper, "Octagonal Ventilation of the Davis-Daly Copper Co." The omission of the latter paper was a disappointment to the metal-mining men. The remaining paper, "Determination of Electric Equipment for a Mine Hoist," was read in abstract by the author, Graham Bright, and occasioned considerable discussion. Methods of hoist calculations and the various factors entering into the design and selection of electrical equipment were features of the paper.

Geologists' Meeting

On Wednesday morning two technical sessions were held at Irem Temple, the general joint meeting conducted by the Society of Economic Geologists and the session on mine accounting.

The meetings of the Society of Economic Geologists, which met for the first time with the A. I. M. E., were very successful and well attended. This society, which is international, meets twice yearly, once with the Institute and once with the Geological Society of America. The morning meeting was presided over by Professor J. F. Kemp.

An interesting paper on the occurrence of lead and zinc in Pennsylvania was read by Professor Benjamin L. Miller, of Lehigh University. Although Pennsylvania, so renowned as a coal state, is not known as a metal producer, lead and zinc in small quantities have a wide distribution and occur in all formations from the pre-Cambrian to the Triassic. In a few localities, mines have been worked from time to time, and the first brass made in the United States was made in part from Pennsylvania zinc. Doyle's mine, in the Triassic near Doylestown, produced galena in 1863-64, and in Landcaster County there were several producers in the 60's and 70's, one of which was bought for

$100,000 in 1873 and equipped at a cost of as much more, under the direction of E. G. Spilsbury.

Near Phoenixville, zinc was mined in 1835. Here there are several lodes or fissure veins, with a gangue of calcite, dolomite, and ankerite, a width up to 4 to 6 ft., and continuous as far as 1,000 ft. Much pyromorphite was found near the surface. In Blair County, near Birmingham, lead and zinc ores were worked as early as 1778. The most important Pennsylvania deposits, however, were two miles from Bethlehem, at Credensville, which were described in the first volume of the Institute *Transactions*. These mines were first mentioned in 1830, and at the surface were calamine ores, which changed to sphalerite in depth. There was no lead. In 1853, furnaces for making zinc oxide from these ores were built, and in 1859 it was possible to produce spelter at a profit. These mines were actively operated up to 1893, and produced 90,000 tons of spelter and 50,000 tons of zinc oxide, valued at $20,000,000. Since 1893 there has been only exploration work. The New Jersey Zinc Co. has drilled the property, and there is a possibility of renewed activity. Professor Miller believes that the lead and zinc ores of Pennsylvania have been leached from the various sedimentary strata by circulating artesia waters, and deposited in concentrated form, as Siebenthal supposes to be the case for the Joplin ores.

F. L. Hess Presents Paper on Bolivian Tungsten

The paper of Frank L. Hess, "Some Unique Bolivia Tungsten Deposits," was read by Prof. J. Volney Lewis, secretary of the Society of Economic Geology, in the absence of the author. This paper is presented in full in this issue, having been submitted by the author to *Engineering and Mining Journal* for printing, the Society of Economic Geologists having so far no fixed method of publication. This paper, which contains a description of some novel geological features, will be found to be very interesting.

Mr. Hess' paper was commented on by Professor Miller, who recalled that in the Bolivian highlands the ores were worked for silver only for 400 years, beginning with 1544; but in the early 90's cassiterite was recognized in the rejected portions, and later the Great War stimulated the demand for tungsten, and also for bismuth, all contained in this group of ores. This metallogenetic province, containing tin, tungsten, silver, bismuth, and antimony, is practically confined within the political boundaries of Bolivia.

C. L. Baker's Paper on the Catorce District

The paper on the "General Geology of the Catorce Mining Distruct," by C. L. Baker, was read by Secretary Lewis. It follows in part:

"The district of Catorce, San Luis Potosi, ranks among the first half-dozen silver-producing camps of Mexico. The Sierra Catorce is the highest range of the region, the summits reaching altitudes of over 11,000 ft. With the exception of a few cliffs of the erosion escarpment of the lower limestone and the canyon walls below the main town of Catorce, which is the highest town in Mexico, the gently rounded slopes are characteristic of a maturely eroded mountain range composed of folded sedimentary rocks. As is usual in desert regions, the heavy bedded limestones are the most resistant to erosive forces. Folded into anticlines, they form the mountain ranges; and the intermontane valleys and basins, originally carved out of less resistant shales, clays, marls and sandstones, are covered by debris, forming a mantle with surface gradually rising upward toward the hills. In time, the debris buries, in deposits formed from their own ruins, all but the highest summits of the original mountains; some of this region has already nearly reached this stage. In vegetation, topography, and prevailing hues of the desert landscape, the Catorce region greatly resembles parts of Nevada and the Mohave Desert.

"Metamorphic rocks are exposed in the canyon from the main town of Catorce westward to near the canyon's mouth, and are divided into two series. The relationships between the two are unknown. The age of the metamorphics is not known; they might in part be as old as pre-Cambrian or as young as Jurassic. Rocks very similar to both series have been described by Dr. Carl Burckhardt, as the lowest exposed at Zacatecas. The youngest of the two metamorphic series at Zacatecas has been shown by Burckhardt to be marine Upper Triassic, but the age of the older series, of the sericitic schists, at Zacatecas is unknown.

"The sedimentary rocks overlie the metamorphic rocks with strong angular unconformity. From the base upward a generalized section of the sedimentary rocks follows:

"1. Conglomerate, purple, green or brown, coarser below and finer above; the water-worn pebbles are chiefly quartz, of the underlying metamorphic series, and crystallines.

"2. Sandstone, argillaceous, below, and shales, arenaceous, above; irregularly colored green, purple, brown or yellow.

"3. Shales, marly, below, and calcareous marls with thin interbeds of limestone above; grades upward into limestone; color gray, weathering pinkish or yellowish.

"4. Limestone, heavy bedded, dark gray or dove colored, fine-grained (as are all the limestones); has nodules and lenses of dark chert. Fossils are probably of lower Upper Jurassic (Oxford). All the more productive ore deposits appear to be in this limestone. Its thickness is at least 900 to 1,000 ft.

"5. Marls and thin limestones interbedded, with nodules of phosphatic (?) limestone.

"6. Limestones, dark gray, medium to thick bedded, with nodules and lenses of black chert; ammonite fossils.

"7. Limestone, thin bedded, with layers of marl, blue-gray, and nodular chert. Members 4 to 7, inclusive, apparently give a complete section of all the Upper Jurassic.

"8. Limestone, medium to heavy bedded, dark blue-gray, with chert nodules. Basal beds of this member may yield lowermost Cretaceous fossils. There may be higher Cretaceous strata to the east, but they do not appear to outcrop within the area of the mining district.

"In general, the upper sedimentary series is folded into a rather broad dome. There are a number of minor flexures in the broad domical structure and also quite a number of faults of only medium amounts of displacement. All faults noted are of the gravity (normal) type. Most of the upper town of Catorce lies on a sunken block at or near the summit of the dome, the sides of the sunken block having been primarily formed by means of faults.

"The igneous rocks are basalt or basic andesite which forms a plug about one mile northeast of the upper town of Catorce. It is found on the top of the ridge. The intrusive cuts the highly colored shales and sand-

stone member on the southwest and the limestone on its other sides.

"Porphyry dikes, probably of quartz-monzonite or a related rock, cut the sedimentary series in a general north-south direction. The dikes vary in width from at least 1,000 ft. almost to the size of stringers. They may possibly be offshoots of one main dike. There was not the slightest trace of contact metamorphism visible to the unaided eye at contacts of the dike rock with any of the sedimentaries.

"Spurr and Garrey have described two bodies of quartz-monzonite-porphyry near a large fault with at least 1,500 ft. displacement at the eastern base of the Cerro del Fraile, about nine miles east of Potrero. At this place is situated the Dolores mine, a contact-metamorphic deposit of copper minerals. There is a possibility that a deep-seated intrusive igneous mass underlies the Catorce district and that the dikes may be apophyses of this mass.

"The primary gangue minerals of the mineral deposits are calcite, quartz, rhodochrosite, and possibly some others, including anhydrite. The primary ore minerals are mainly sulphides of iron, iron and copper, lead, zinc, arsenic, antimony, and bismuth. Mercury sulphides are found south of the main district. Subsequent alteration of the sulphides formed, principally in the oxidized and leached zones, the haloid silver minerals, the double salts of silver and possibly even more complex silver minerals.

"The main deposits are fissure veins in the lower limestone. The intersections of veins were the sites of rich bonanza oreshoots. The fissure veins are probably not all along fault lines. Some of them may follow joint planes. There are also quite a number of pocket deposits, as in the other regions of limestones in northeastern Mexico. Most of these pockets occupy the sites of former solution channels and cavities. No deposits appear to have been found in the shale, in which, from the incompetent nature of the rock, there probably could not have existed open fissures or channels. However, mineralizing gases may have penetrated these arenaceous shales and encountered more favorable conditions (physical, chemical, or both) in the overlying limestones. Judging from the physiographic history of the region, the primary ores were originally deposited probably about 10,000 ft. beneath the surface."

D. H. Newland Discusses "Relation of Gypsum Supplies to Mining"

A paper, "The Relation of Gypsum Supplies to Mining," read by the author, D. H. Newland, proved interesting and is here reproduced in part:

"Certain observations from the field and laboratory suggest the need for recasting some of our ideas about gypsum as a rock-forming mineral and in relation to supplies for industrial use. Until about twenty-five years ago, the use of gypsum was confined almost entirely to agriculture. During the last quarter century, though, its usefulness has been greatly developed, particularly in the building trades, which now absorb most of the gypsum produced. In 1919, according to the U. S. Geological Survey, the output of crude gypsum was 2,240,163 tons, a gain of 912 per cent in twenty-five years. About one-half of this production was mined in New York, Ohio, and Michigan, where the proved supplies can hardly be regarded as over-large when viewed in relation to the rapid expansion of industrial requirements.

"The two calcium-sulphate compounds, gypsum ($CaSO_4.2H_2O$) and anhydrite ($CaSO_4$), are the more stable forms of a series that includes at least two other members, so-called half-hydrate ($CaSO_4.\frac{1}{2}H_2O$) and soluble anhydrite ($CaSO_4$). Each of the latter readily takes up water to recrystallize as gypsum, and consequently is incapable of existence under ordinary geological conditions; also each can be prepared from gypsum by the application of heat within certain temperatures, the process on which is based the manufacture of commercial plasters. If the temperature limitations are not observed, the result of the calcination process will be insoluble anhydrite, which compared with the soluble form, takes up water very slowly, so as to be of no practical use, although actually it is soluble and in time is convertible into gypsum like the other forms.

"The association of anhydrite with gypsum is rather common in deposits that have been mined or explored beyond the outcrop zone; that is, to a depth of over 100 ft. A study of these occurrences would indicate that the form which calcium sulphate takes depends on environment; that is, the combination of physical and chemical conditions that pertains to any particular region above or below ground. There is nothing unusual about such relation in the occurrence of minerals in general, but its probable bearing on the question of gypsum supplies justifies some effort in the investigation of the details.

"It appears that the deposition of gypsum and anhydrite at atmospheric pressures is not simultaneous, but each substance crystallizes during a separate range of temperatures, which is lower for gypsum than for anhydrite. It requires only moderate temperatures to expell the combined water of gypsum.

"In view of the considerable change in volume (30 to 40 per cent decrease) that accompanies the transformation, it is reasonable to suppose that pressure lowers the temperature of dehydration wherever there is opportunity for the released water to find escape. The inference to be drawn from the information at hand is that gypsum becomes unstable under conditions of moderate temperature and permanent load that characterize all deeper deposits in the extensions of the outcrops.

"On the other hand, anhydrite represents the unstable sulphate at atmospheric pressure and average surface temperatures. The prevalence of gypsum at the surface, its deposition by ground waters or in open cavities below the surface (veins), and the actual process of hydration which can be followed in samples of anhydrite exposed to the atmosphere witness this fact. The change of anhydrite to gypsum in connection with some of the Western deposits was described by A. F. Rogers, who seems to have been the first to note the occurrence of the former as a rather common mineral in this country. The process of hydration has been in progress, no doubt, wherever anhydrite by erosion, faulting, or other agency has been brought to the surface or so near the surface that the pressure developed by the 50 per cent or so increase in volume could find relief against the counter effects of load.

"There is considerable information at hand to show that the range of stability for gypsum under vertical load is so small that it will have to be given serious consideration in connection with the question of future mine supplies. The most circumstantial evidence comes from the mines in the East, where operations have been in progress the longest time. In western New York,

where the deposits may be followed from the outcrop under an increasing cover in the direction of the dip, anhydrite begins to appear at 150 ft. or less and within the next 100 ft. becomes the predominant mineral. It is a fair inference that 250 to 300 ft. marks the limit beyond which gypsum cannot be expected in any considerable quantity, that is in its usual form of occurrence as seams under permanent load.

"Drill records generally are not of much service, as they are likely to show all the calcium sulphate in the form of gypsum, on account of the similarity in appearance of the two minerals in a granular condition, like the drillings made by oil-well rigs, which have generally been used. It is quite probable that some of the reported discoveries of thick gypsum beds in the salt mounds of the Gulf coast at depths of 1,000 ft. and more are to be explained on this ground. Error in identification may be held to be largely responsible for the impression, more or less general, that anhydrite is an uncommon mineral. It may be said that the domes of the Gulf region probably come within the class of structures that are an exception to the prevailing methods of occurrence where pressure is regarded as a direct factor of depth."

Dr. Locke: "Geology Applied to Ore Hunting"

Dr. Augustus Locke presented a thoughtful paper on "Geology Applied to Ore Hunting." He pleaded for a recognition of the difference between the science of economic geology and the technique of ore finding, or a determination of the criteria between favorable and unfavorable indications of the existence of orebodies. With existing treatise on economic geology only, Dr. Locke likened the geological engineer to the bridge builder with only books on physics to refer to, or to the physician armed with only books on anatomy and physiology. He described an interesting experiment whereby the gossan covering an area of ore, and another covering worthless pyrite, were made the subject matter for a test examination by six geologists, to select the favorable from the unfavorable gossan. Of the six, only one guessed right, the others guessing right or wrong according to chance. This indicates the great difference in observing and reasoning powers in different men. Dr. Locke viewed the function of the Society of Economic Geologists as in part the building up of an ore hustling technique. He also thought that the society might criticise court testimony in apex cases; and lastly that it might give advice to the younger geologists.

The "Mine Accounting" Session

R. V. Norris, presiding over the session on mine accounting, introduced John B. Dilworth, who read an abstract of his paper, "Underground Mine Development, Its Definition and Valuation." This paper relates to the room-and-pillar system of mining horizontal coal seams in bituminous coal mines, but as certain similar features of classifying expenditures and valuing mine development exist in both coal and metal mines, the subject was of considerable interest to the metal men, although their attendance was in the minority. H. B. Fernald, in the discussion following, called attention to the fact that the Treasury Department is very anxious to secure the opinion of Institute members on the subject of mine costs and valuations, and also told of the activities of the Institute's committee on mine accounting, of which he is chairman. Other discussion was presented by J. H. Allport, R. D. Hall, Mr. Norris, and Edwin Ludlow.

Other papers read at this session were as follows: "Advances in the Preparation of Anthracite," by D. C. Ashmeade; "The Automatic Substation for Coal Mines," by R. J. Wansley, and "Electric Power a Factor in the Anthracite Field," by W. A. Thomas, these papers having been omitted at earlier sessions.

Inspecting "Wyoming Red Edge" Shovel Making

Following the technical sessions, members were taken on the second of the three automobile tours planned by the committee to the plant of the Wyoming Shovel Co., at Wyoming, and there given an opportunity to see the various stages of manufacture of "Wyoming Red Edge" shovels and picks. This plant is complete in every detail, and the several steps of operation were watched with great interest. Through the courtesy of this company an elaborate luncheon was served on the upper floor of the main building. Each guest found at his place a novel souvenir in the form of a "trench" shovel; the assumption being that every one should "fall to," which was done with little delay. After luncheon, President Ludlow, on behalf of the Institute, extended a vote of thanks to the officials of the Wyoming Shovel Works, to which H. T. Potter, of the company, replied.

Owing to the interest shown in the geology session, which was resumed upon the return from Wyoming, the general technical session was called off. One of the papers, "Relation of Gypsum Supplies to Mining," by D. H. Newland, and scheduled for this meeting, was presented at the morning geology session, as noted. The two other papers, "Queen Mine Hearth Roaster," by J. Moore Samuel, and "Flotation of Pyrite," by W. S. Morley, will appear in the *Transactions*.

Professor Kemp: "The Structure of the Anthracite Region"

The afternoon session was presided over by H. M. Chance. A paper by Prof. J. F. Kemp on "The Structure of the Anthracite Region," illustrated by lantern slides, was of extraordinary interest, showing that during faulting and folding the shales, clays, and coals flowed freely, like putty, so that the faults and folds may disappear in an extraordinary short distance. Many unique examples were presented. Comments on the paper were made by H. M. Chance, W. S. Ayers, Dr. George H. Ashley, and J. V. Lewis. Dr. Ashley, state geologist of Pennsylvania, presented an interesting economic study on "Deep Seated Oil and Gas in the Appalachians." Dr. Ashley finds that only hope of new discoveries of oil or gas in Pennsylvania is in depth; and believes the Oriskany sandstone in depth to be a possible source of gas and less possibly of oil. E. De Golyer read a paper, "The Coming of Water in the Mexican Gulf Coast Wells."

Vulcan Iron Works and Hazard Wire Rope Plant Visited

Excursions were made to the Vulcan Iron Works and the plant of the Hazard Wire Rope Co., both in Wilkes-Barre. At the former plant the visitors were shown through the shops and then taken to the casting plant, where a twenty-ton "pour" was made, the molten steel being poured into molds. At the Hazard plant, the visitors were shown the methods of winding various sized wire ropes. In the laboratory special tests were made of separate strands and wire rope.

The dinner and ball which were tendered the visitors by members of the local section were held at the Irem Temple on Wednesday evening. During the dinner the Brunswick Quartet gave a number of vocal and instrumental selections, and this part of the program was supplemented by a local monologist, who gave several clever imitations, most of which related to the coal miners of different nationalities. R. V. Norris, general chairman of the local committees, spoke briefly of the work done by them and also called attention to the fact that the meeting celebrated the fiftieth anniversary of the Institute. He read several telegrams from absent members, including Herbert Hoover and William Kelly. He then introduced the toastmaster, J. F. Kemp. Professor Kemp, in happy vein, sketched the early existance of the Institute and then introduced Henry S. Drinker, who spoke of his early associates and the men who, with himself, have done so much for the organization. President Ludlow, the next speaker, told of the association of the society with the coal regions and also sketched briefly the progress of the district and its economic importance. Colonel Arthur S. Dwight related experience during his recent visit to Europe as a member of the delegation representing the Founders Societies. Lieutenant Colonel J. A. S. Ritson, a British mining engineer, was the last speaker. Colonel Ritson is at present making a study of American coal-mining methods and will remain in this country for some time.

The Trip Through the Coal Fields

On Thursday, an all-day excursion was held, starting from the Irem Temple at 9 a.m., and covering parts of the Wyoming, Lehigh and Southern anthracite coal fields. On this trip an excellent opportunity was given to observe the outstanding geological features as well as many other interesting points. The Ashley Planes, which were described at the technical session on Monday afternoon, were passed en route, and it was possible to get a general idea of their operation, although no inspection of the planes was made. The first stop was made at the Hauto power plant of the Pennsylvania Power & Light Co., in the Lehigh district, and here the 60,000-kw. plant was given a hasty inspection.

At Greenwood Park the party was served luncheon through the courtesy of the Lehigh Coal & Navigation Co. After the luncheon, President Ludlow, in tendering a vote of thanks to the officials of the company for their hospitality, spoke briefly on the history of the region and told of the development of the coal industry. J. B. Warriner, general manager of the Lehigh Coal & Navigation Co., replied to Mr. Ludlow's speech, and then called attention to a first-aid demonstration that was given by three of the company's teams. After the demonstration, the visitors returned to the cars and the trip continued. At the water shaft of the Tamaqua colliery a stop was made to inspect the surface equipment. Here pumping, or hoisting of water, is done by means of 3,600-gal. buckets from a shaft 800 ft. deep. The hoist used is one of the largest induction-motor hoists in the world.

After leaving the Southern field and re-entering the Lehigh field, several of the older strippings were passed. Near the Harwood colliery the party left the cars to inspect the stripping pit now being used in connection with mining the Mammoth and Four-Foot veins by the Harwood Coal Co. Several blasts were exploded while the visitors were viewing the stripping operations. After passing through Hazelton, the next stop was made by the party at the old Milnesville stripping. Here the overburden has been removed for a depth of 300 ft. The old Hollywood stripping, on the opposite side of the road at this point, is one of the oldest in the anthracite field, and affords an unusual opportunity to see the folding of the anthracite measures. Wilkes-Barre was reached at about 6 o'clock. Most of the visiting members returned to their homes that evening or on Friday morning, although a few remained for special trips that were arranged by a special committee.

A New Nine-Hearth Roasting Furnace

A modification of the ordinary McDougall roasting furnace has been developed at the Copper Queen smelter at Douglas, Ariz., and is described in a paper prepared by J. M. Samuel for the American Institute of Mining and Metallurgical Engineers, entitled the "Queen Nine-Hearth Roaster."

The following assumptions were made in the development of the design of the new plant: (1.) Outside diameter to be 18 ft. (limited by size of building). (2.) Sulphur elimination to be 30 lb. per sq.ft. of hearth area per twenty-four hours (standard practice at the Calumet and Arizona smelter). (3.) Outgoing gases to contain 5 per cent sulphur dioxide by volume. (Higher content of sulphur dioxide has been found to result in decreased capacity.) (4.) Gas velocity through ports not to exceed 10 ft. per second. (With low gas velocity a given draft will draw more air through the furnace, and also less trouble will be had from accretions.)

Conservation of heat was obtained by building the bottom hearth of Kieselguhr insulating brick and providing space for a reasonable bed of roasted ore. Lateral radiation losses were taken care of by backing the walls between skewbacks with a layer of insulating brick and also by reducing the distance between hearths to a minimum. The close hearth spacing was obtained in the following ways:

1. A conical arch with a rise of $\frac{3}{32}$ in. per ft. was used, fire brick of special shape being used in the construction. In addition the arches were tapered from 8 in. thick at the outer end to 4 in. thick at the inner.

2. The arms were set parallel to the arches and were made of 6-in. steel casing.

3. The clearances were reduced to $3\frac{1}{2}$ in. as the minimum allowance between the rabble teeth and the hearth; also between the top of the arm and the underside of the hearth roof.

The top hearth was made of cast-iron plates, to allow a minimum transfer of heat from the outgoing gases to the incoming ore. Six rabble arms were used on this hearth, with 12-in. blades set at between 20 and 30 deg.

Inasmuch as probably 40 to 50 per cent of the sulphur oxidation takes place as the ore drops from one hearth to the next, special attention was paid to securing a proper amount of air at the drop holes. Also, oxidation is promoted by frequent stirring. For that reason the roaster was equipped with a variable speed motor so that any speed between one revolution in twenty seconds and one in fifty-five seconds could be obtained.

Tests of the new roaster showed considerably increased capacity, especially with a feed low in moisture. Low moisture also results in increasing the temperature of the product and increasing the sulphur-dioxide content of the outgoing gases.

THE EASTERN DESCENT FROM QUIMSA CRUZ (TRES CRUCES) PASS ALONG THE QUIME RIVER
The old trail to Pacuni climbs the hill to the right. The trail along the stream leads to Quime and the interior of Bolivia.

Some Unique Bolivian Tungsten Deposits

Tin and Tungsten Occur in and Around Quartz Monzonite and Porphyries, the Metals Being Deposited From Watery Solutions Given Off by These Rocks on Cooling—Tungsten Is Deposited Further From Source Than Tin Minerals—Mining and Milling Methods

BY FRANK L. HESS*

OF THE BOLIVIAN TUNGSTEN DEPOSITS that came into operation and produced notable quantities of tungsten ore during the Great War, three near Oruro, the Jorge Quinte, Ascencion, and San Antonio, are not far apart, but are greatly different from one another, and, so far as I have been able to learn, each is unique in its characteristics. Besides these three, other tungsten deposits with unusual characteristics and to which further reference will be made have been found at Pacuni, Quime, and near La Paz.

All three of the deposits near Oruro are situated in the western range of foothills of the eastern cordillera of the Andes. The Jorge Quinto and Ascencion mines are in the Condeauque district, about twenty-eight miles northeast of Oruro and eleven or twelve miles from Paria, a station on the Ferrocarril de Oruro a Cochabamba. The San Antonio mine is about nineteen miles north of Oruro.

The mines are reached by roads that are good during the winter or dry season, but which are so abominably bad during the summer or wet season that they become impassable for wagons or carts. Although the area is well within the tropics, the weather is always cool. There are no hot days, even in summer, and a fire in the evening is at all times a pleasurable luxury. In the winter, water sometimes freezes several inches thick during the night, though the middle of the day is usually warm and pleasant.

The Andes in this region are, in general, smoothly rounded, and have long, even slopes thinly sprinkled with angular pieces of quartz and quartzite over a skin of soil. Here and there are occasional bold crags of quartzite, and along the slopes are less prominent outcrops of quartz veins or of shale or sandstone hardened by silica. The outcrops run in various directions, but my time did not permit an unraveling of the systems, even were it possible, and no common strike could be determined. None of the peaks are snow-clad, and none show the effect of more than incipient glaciation, though

*Paper presented at the joint meeting of the Society of Economic Geologists and the American Institute of Mining and Metallurgical Engineers, Wilkes-Barre, Pa., Sept. 14, 1921.

forty-five to sixty miles to the south peaks of equal height have the western side of their crests hollowed out by glaciers. From the foot of the range great gravel plains slope gently to the ancient lake bed surrounding Oruro. Through the gravels have been cut shallow channels by streams that during glacial time were much larger than they are now.

Geology of Deposits Near Oruro

In its broader lines the geology is comparatively simple, but in its details it is complex. The Andes were apparently formed by the crumpling of a great thickness of sandstones and shales (in much of the cordillera hardened to quartzites and slates) and the simultaneous or later intrusion of an enormous mass of quartz monzonite that occupies the center of the range. The sediments lie on the quartz monzonite and in general dip away from it, but show great variations in local dips and strikes. Molten rocks closely related to the quartz monzonite burrowed their way up into the sediments, cooled more quickly and under less pressure, and so developed a different texture. These are the quartz porphyries and similar rocks. There are also numerous "basic" dark-colored dikes.

In some areas the original thick covering has been eroded from the quartz monzonite, as in large parts of the area lying between Quimsa Cruz (Tres Cruces) Pass, probably thirty miles north, and Huayni-Potosi, thirty or forty miles farther, but no granite is known to outcrop for many miles south of the pass, though the porphyries are to be seen at many places, as at Oruro, Morococala, Negro Pabellon, Huanuni, and others. The folding and adjustments due to mountain-making caused a great deal of cracking, jointing, and faulting, so that not only may dips and strikes not be continuous, but the different beds are in many places faulted past each other.

The Jorge Quinto Scheelite Deposit

The Jorge Quinto scheelite deposit is near the summit on the west side of a smooth ridge, and the main level is at an elevation of about 14,650 ft., about 2,000 ft. above and in plain sight of Oruro. From the crest of the ridge jut prominent quartzite masses reaching perhaps 100 to 200 ft. in height. The quartzite governs the direction of the ridge, which here runs northwest. At the foot of the ridge on both sides are small streams. The rocks are clay shales, sandy shales, and sandstone partly hardened to quartzite, and these are cut by several rather basic dikes.

The quartzite that forms the top of the ridge is about 300 ft. thick, and above the surface is very hard, but below is mostly comparatively soft, though some parts are hard. The beds are practically vertical and strike northwest. On the southwest side of the quartzite is a bed of clayey shale of uncertain thickness but probably between 50 and 100 ft. This bed is succeeded by sandy shales in which are interbedded sheets of sandstone, and at the foot of the hill, more than a half mile away, are thick beds of carbonaceous shale. On the northeast side of the ridge the quartzite gradually grades into sandy shale, which in turn is succeeded about three hundred feet from the quartzite by carbonaceous shale of unknown thickness.

Breaking through the shales near the top of the ridge on the northeast side, perhaps 200 yd. from the tungsten deposit, is a mass of dark, greatly altered, fine-grained, basic rock that was possibly a diabase. There are other outcrops lower down the slope, but they are mostly covered by débris. Another altered basic dike was cut in an adit about 100 yd. from the lode.

Faulting Extensive and Recognized by Crushed Material

The rocks of the area are everywhere greatly broken by faulting, and wherever they are hard enough to preserve the marks, or where there has been enough infiltration of silica to make a hard surface, slickensides are common, especially along the quartzite outcrop on the crest of the hill. But most of the faults are to be recognized only by crushed material, for unless there was no movement for a considerable time along cracks in shales, solutions could not percolate through to deposit quartz, as with very little movement the fine material would be ground to a mud that would effectually stop up the openings. How much faulting and crushing there has been in this area is graphically shown by a crushed zone on the road about halfway between the top of the mountain and the creek on the northeast side, where shale and sandstone are mixed in a heterogeneous mass more than 150 ft. wide.

General Description of the Ore Deposits

The tin and tungsten deposits of Bolivia are found in and around both the quartz monzonite and porphyries and are deposited from the watery solutions given off by these rocks on cooling. No other source is known for either metal, and it is fair to suppose that if the igneous rocks are not visible it is because they have not yet been uncovered by erosion. In general, the tungsten minerals are deposited farther from their source than are the tin minerals, which means that they are deposited at lower temperatures and usually nearer the surface than tin deposits, and so probably will not be found at such great depths. However, the zones of tin and tungsten deposition grade into each other, and not only can no line be drawn between them, but they may be coincident, for erosion may have removed the upper part of the veins where tungsten alone was deposited and the more highly heated zone may have progressed beyond that in which tungsten minerals were already deposited, and cassiterite then have been deposited on the tungsten minerals. Such an association of minerals is common and has caused much disagreement as to depths and temperatures of deposition.

The Jorge Quinto Mine

The Jorge Quinto mine is in an area of tungsten deposits, most of which are small wolframite veins. There are also a number of antimony deposits within a mile or two, and a little copper is found in veins close at hand. No tin mines are operated within a number of miles of the property. The only other known scheelite deposit of workable size in the vicinity is the Ascencion mine, about three miles south.

The Jorge Quinto lode is a deposit of scheelite in a brecciated zone following a fault that cuts the quartzite and at the surface strikes N. 80 deg. W. and dips 43 deg. S. 10 deg. W. The lode cuts across the mountain through a saddle and ends rather abruptly on the west at the edge of the quartzite. On the east the lode rather gradually loses its richness and character as it enters the shaly material into which the quartzite grades. At the summit the lode has a very smoothly slickensided foot wall, above which is six to thirteen

feet of brecciated material of all degrees of fineness from powder to pieces a foot or more across. The breccia is cemented by white ankerite, a carbonate of calcium magnesium and iron, and in a few places the ankerite is six inches thick. It is harder than calcite, and was mistaken in the field for adularia.

The fault is fairly straight and the breccia is hard and solid. On the levels below, however, the fault is not straight, but has numerous curves, and the breccia is broken to a mass of fine material from sixteen inches to sixteen feet thick. This fine material is known as *yampu*, said to be an Aymará word. The coarse ore is known as *broza*. Where the lode is narrowest it is said to be very rich, 40 to 50 per cent WO_3.

The slickensided part of the fault cuts through the crushed material at many places, so that part of the ore is above and part below, but by far the larger part is above. The fault is in most places lined with ankerite that has taken a glassy polish. At the surface the trace of the striæ on the fault is S. 43 deg. E., and the ore shoots run in about the same direction. At the west end of the principal or *cancha* level the lode stops at the shale as it does above. On the next level below it ends in hard sandstone a little before the shale is reached, or at least it becomes too lean to work profitably. On the east also the lode becomes lean, and as the quartzite becomes shaly there are only occasional good bunches of ore.

There appear to be three principal shoots dipping with the striæ on the fault and each 100 ft. or more wide, but the lode between them is by no means barren. The ore has been followed down in the sandstone more than 300 ft. below the highest outcrop, and still retains its width and richness.

Ore Unusually Free From Impurities

As has been said, the ore is a mass of angular fragments cemented by ankerite, and it is, in my experience, unique in this feature. The fragments are made up of quartzite and pieces from an older lode that was also a breccia. Some of the fragments of the old lode are quartzite with a coating an eighth of an inch or more thick of calcite carrying more or less iron and probably a little manganese. On the calcite is deposited gray scheelite so fine grained that it is unrecognizable to those not acquainted with the ore. Other pieces of quartzite have scheelite adhering directly to them. Some fragments are merely skeletons of iron rust and silica and were apparently originally either siderite or ankerite. Still others are nearly pure scheelite, and scheelite is found only as broken pieces of the original lode. The ankerite is apparently of a later generation and shows little or no weathering. The earlier carbonate seemed to carry much more iron, and weathers to soft iron oxide. The ore as mined is thought to have averaged 5 per cent WO_3, and is extraordinarily free from harmful impurities.

From the observations noted the history of the lode appears to have been about as follows: The quartzite was cut by a fault extending into the shales on each side, but on the west was dissipated in the thinly bedded clay shales, and enough mud was made by the movement to prevent the circulation of solutions in the shales. On the east the fault became progressively dissipated as the sandstone graded into thinly bedded sandy shales. Solutions from some igneous rock below brought up iron-bearing calcite, probably carrying some manganese, and this was the first mineral to precipitate in the cracks made by the fault. Calcite was followed and probably in part accompanied by scheelite and a remarkably small quantity of quartz—few metalliferous veins deposited from hot waters carry so little. Probably soon afterward there was another considerable movement along the fault, by which the rocks were broken finer and the carbonate scheelite vein was broken with them. The movement was followed or accompanied by solutions carrying a great quantity of ankerite that cemented the broken rock. After cementation, movement again took place along the fault, probably a more diagonal movement, as shown by the slickensides, and the ore was crushed to the condition in which it is now found.

As has been shown, the lode crosses the quartzite at an acute angle, the quartzite striking NW. and the lode N. 8 deg. W., leaving an angle of 35 deg. between them, so that the lode should have a length of about 580 ft., measured in a straight line, within the quartzite, and this corresponds closely to the surveyed length of the workings. Apparently little extension is to be looked for on the west, but it is possible that the shaly sandstones on the east may have held cracks sufficiently open for some deposition of ore.

Mining Carried On by Means of Adits

The location of the deposit, on a ridge, makes the working of the mine by adits the easy and natural method, and, except along the lode, the rock holds up well. The *yampu*, or crushed ore, does not, of course, hold up, and must be supported. Some dry-wall work is used and some timbering. One *pique*, an incline following the lode, is lined like a well. For timbers eucalyptus from Cochabamba is used, and it gives excellent satisfaction. Some Oregon pine is used to lay on eucalyptus stulls.

Owing to bad engineering advice, the mill was located on the Rio Paria, at Paria, eleven or twelve miles away, for the sake of the water supply. Four auto trucks were purchased with which to transport the ore, and they did the work well during the winter, but when the rainy season came on they mired hopelessly, and it was impossible to move ore while others were selling at phenomenal prices. Had the plant been built near the mine it would have been necessary to move only concentrates, about one-fifteenth of the weight of the ore, to Paria, and this could have been done with llamas that would have picked their way across the slopes easily. An *ingenio*, or milling plant, was started in the valley on the northeast, a road was made across the ridge, laborers' houses and a dam were built, and a large quantity of machinery and supplies was moved to the top of the hill. Just at that time news came of the signing of the Armistice, and tungsten mining in Bolivia was dead!

The Ascencion Scheelite Mine

The Ascencion scheelite mine appears to be a second Atolia, and is probably now the largest tungsten mine in Bolivia, but I did not sample the mine, and so cannot give an accurate idea of its richness. Placer scheelite was discovered here in 1909, and the vein was discovered in 1915. The mine is just over the crest of the first range of foothills, and thus out of sight of Oruro, and three miles south of the Jorge Quinto mine. In its mineral composition the vein is quite as unique as the Jorge Quinto. It is at almost the same altitude as

the Jorge Quinto, and, although not a high mine for Bolivia, the main drift (about 14,400 ft. high) is about as high above sea level as the summit of Mount Whitney, the highest mountain in the United States. The uppermost part of the vein is several hundred feet higher.

The country rock is a yellow sandstone, probably the same as the quartzite at the Jorge Quinto mine, but here altogether too soft to be so designated. The sandstone is interbedded with the same shales, and there is also a dark-brown rock that from a hasty field examination seemed to be an arkose. The rocks are more or

DUMP AND BUILDINGS AT THE ENCARNACION MINE NEAR ORURO, BOLIVIA

less crumpled, but strike approximately north, with very high dips.

Standing on the hill 300 ft. or so above the portal of the mine, the positions of the Negro Pabellon, Llallagua, and other tin mines can be made out some miles to the south. Close at hand are numerous meager copper and wolframite prospects, and at a point a mile or so east stibnite was mined during the war. At numerous places along the foot of the hills are hot springs, and on cold winter mornings the vapors can be seen for many miles across the *altaplanicie*. Despite so much mineralization and thermal activity, the sandstones show a surprising lack of silicification, but they are, however, seamed with innumerable veinlets of hydrous iron oxide, with here and there a little magnetite. Faults are numerous, but the soil covering the hills prevents their recognition until they are exposed by excavations.

Description of Ascencion Deposit

The scheelite deposit of the Ascencion mine is in the form of a nearly perpendicular forked vein, the main part of which has a strike a few degrees east of north, and the branch a strike about northwest. The parts of the vein are very tortuous, and the curves are of comparatively short radius. A great deal of faulting has taken place along the vein, so that the vein itself and the country rock alongside are much crushed. Along most of the vein the country rock is sandstone, but along a part of the vein it appears to be sandy shale, for shale has been dragged in by the faulting. The shattered vein has been in part recemented by an infiltration of barite and a small quantity of quartz, but is still so soft that most of it can be worked by pick and shovel.

In general the vein is probably between thirty-two and forty inches thick, but in one place it appears to be thirty-six feet wide. This place, however, has not been crosscut, and may contain a horse of country rock. In another place the vein is only five or six inches thick. The average width is probably about forty inches. Apparently the vein was originally composed of barite, a little quartz, and more or less siderite or iron-bearing calcite that is now represented by friable iron-stained material. No pyrite has so far been found in the mine, but were it the original iron-bearing mineral some would now be found even in the oxidized parts of the vein. After the vein had been formed it was crushed by faulting, and scheelite, probably accompanied by a little quartz, filled cracks and spaces in the barite, recementing the vein just as the Jorge Quinto lode was recemented by adularia. There was probably also a later deposition of a little barite and quartz. As in the Jorge Quinto vein also, movement again took place after the recementation, so that the vein was crushed a second time, and as it is very crooked, the crushing is both fine and general over the extent of the vien.

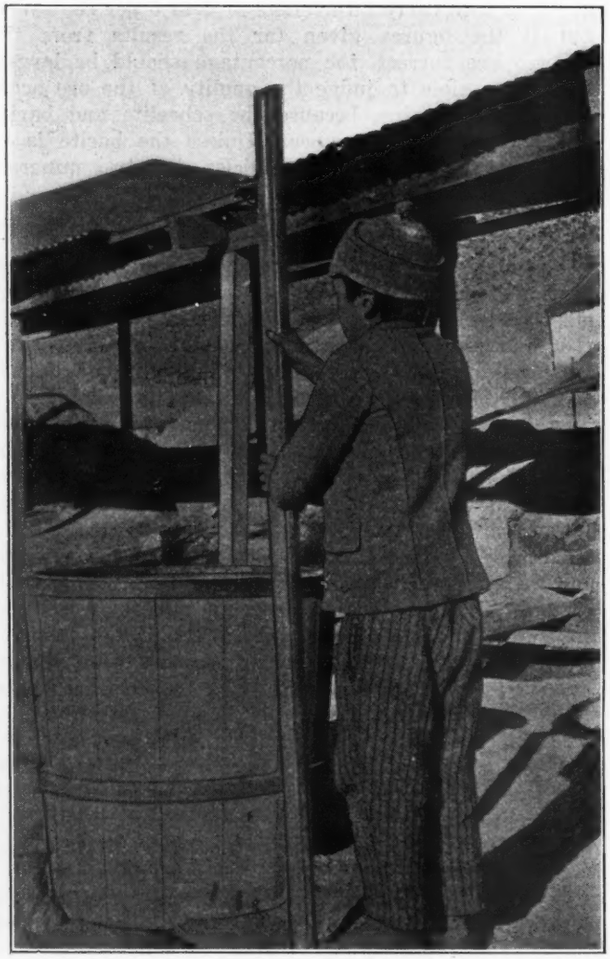
The scheelite is white and mostly fine granular. In places it is from two to eight inches thick, but is generally broken to bits and thoroughly mixed with barite. In most places barite forms much the larger part of the vein. A little stibnite has been found with the scheelite, than which it is apparently later. The ore is said to carry an average of 5 to 6 per cent WO_3, but if the figures given for the results from the *ingenio* are correct, the percentage should be larger. It is impossible to judge the quality of the ore accurately in the mine, because the scheelite and barite are so alike in appearance. Unless the barite is in comparatively large clear particles, the two minerals cannot be distinguished.

Low and Narrow Drifts the Rule at Ascencion

The ore is so soft that most of it can be mined by pick and shovel. The saving in dynamite, however, must be largely if not wholly spent in holding up the roof and walls. Timber is exceedingly expensive and must be brought either from Washington or Cochabamba. Cochabamba is, geographically, near, being only fifty or sixty miles away, but commercially it is about as far away from the Ascencion mine as our northwestern state. There, the only timber obtainable is eucalyptus planted and grown in small quantity and shipped at high freight rates, so that there is little difference in price. Recourse is often had to stone walls and arches, which the miners build remarkably well. However, it happens that Bolivian miners in general are short, and neither of the owners of the mine is much over five feet tall, so that by the time the average *Yanqui* (Yankee) has gone through the mine he has a "kink" in his neck and a "crick" in his back. Not only are the arches low, but the passages are very narrow. The vein averages perhaps a yard in width, and little wall rock except what may be loose is removed, so that when a wall five to six inches thick is put up on each side, the passageway left is only about thirty inches wide, and one is likely to have the sense of oppression that he gets in the crowded passageway of a Bolivian sleeping car. I saw but one ladder in the mine, and that had only six rungs. Instead of ladders, inclines and spiral stairways cut in the rock connect the various levels.

At the mine the ore is sorted by Indian women, and all large pieces are broken to a diameter of two inches or less. The ore is then transported by llamas to the concentrating plant on the west side of the hill and about a mile and three-quarters nearer Oruro, at a point where water is available all the year. The plant is simple, and the following process is used: The ore is crushed under *quimbaletes* (rocking stones or semi-circular steel shells filled with rocks). From the *quimbaletes* the ore goes to a hand jig, the bottom of which is a screen of about $\frac{1}{8}$-in. mesh. The undersize goes to a second jig with a screen of about $\frac{1}{20}$-in. mesh, from which the undersize goes to buddles, of which there are seven, with a diameter of about two yards and a slope from the center to the circumference of about 8 deg. From the buddles the concentrates forming the inner third of the radius are sent to the *levandos*. The middlings, a ring outside the concentrates and about one-quarter of the radius wide, are re-run through the buddles and the remaining outer ring is thrown on the tailings dump.

The *levandos* are the Cornish kieves—tall, stout tubs about 39$\frac{1}{3}$ in. high, about 32 in. broad at the top, and 24 in. across at the bottom. On the side are three stoppers about 3$\frac{1}{2}$, 7 and 11 in., respectively, from the bottom. The *levando* is gradually filled with water, and at the same time concentrates from the buddles are shoveled in and kept well stirred. Meanwhile a boy jars the *levando* with an iron bar, helping to keep the lighter particles suspended while the scheelite settles to the bottom. Tailings are drawn from the top hole, and middlings from the second, but the third hole is apparently used only to drain the water from the concentrates, from which the middlings are carefully scraped and the rich material is removed by hand. The middlings are run through a *lavadore*—a trough with a bottom a foot or fourteen inches wide made of a close turf or some similar substance and with a curved grade that is much steeper at the top. A stream of water runs through it as in a sluice box, and a man keeps pushing the sand up the slope against the current, and the water gradually washes out the impurities. All water from the plant goes to a series of four settling tanks. The concentrates, or *barilla*, are dried in pans heated by *yareta*, a plant that grows in low, rounded masses in these high hills and valleys and that has little in its appearance to suggest that it might be used for fuel. The *yareta* found here, however, is small and dirty, and must be washed. This is done in a tank dug in the bank of a small stream from which the water for the *ingenio* is obtained.



A "LEVANDO" OR KIEVE. THERE ARE NO CHILD LABOR LAWS IN BOLIVIA

BUDDLES. THE ONE ON THE RIGHT HAS BEEN EMPTIED

The capacity of the plant is said to be from ten to fifteen tons a day for one shift of nine hours, from which is produced twenty to thirty quintals (the Spanish quintal of 100 lb. is used in Bolivia) of concentrates carrying from 50 to 58 per cent WO_3, but mostly nearer the lower figure, and the tailings are said to carry 3 per cent WO_3. These figures indicate that the heads carry nearly 9 per cent WO_3, which, judging from the general appearance of the hand-picked ore, seems reasonable.

Heat Separation Suggested

The high specific gravity of the barite gangue prevents the making of very high-grade concentrates without an excessive loss of scheelite in the tailings, and were it not for the barite the tailings would in most places be considered ore of good grade. Sr. J. F. Aguilar Revoredo suggested that as the barite decrepitates on heating, and the scheelite does not, a separation might be made by coarse crushing, decrepitation, and fine screening. There would, of course, still be the same loss in the fines. The process has not yet been tried on a large scale.

Some concentrates that had been shipped to New York are said to have been raised to more than 70 per cent WO_3 by electrostatic treatment. The presence of barite ($BaSO_4$) is, of course, objectionable, on account of the sulphur it contains, and for the presence of which buyers exact penalties.

The barilla is packed on llamas to the railroad at Oruro for about 43c. per quintal, $9.63 per long ton. Freight to the United States is about $125 per long ton. There is now in New York a considerable quantity of the concentrates.

Miners were paid B/s3 to B/s4 per day in 1920. The boliviano is equal to about a third of a dollar, exchange ranging during the first five months of the year 1920 from B/s2.80 to B/s3.30 for a United States dollar—and that is another of the Bolivian miner's troubles!

THE SAN ANTONIO MINE

The San Antonio mine, owned by Sr. Rafael Taborga, was one of the phenomenal tungsten mines that were developed as a result of the high prices for metals brought on by the war. Unfortunately, circumstances kept me from visiting the mine, so that I have only information obtained from others, largely, however, from Sr. Revoredo, who successfully operated the mine for Sr. Taborga. Like the other deposits described, the San Antonio mine is in the outer range of foothills, and the country rocks are the same as those of the Condeauque district, but the lode matter is siderite, in which are "bolsons" or pockets of ferberite, the iron tungstate.

When the high prices for tungsten came during the war, the San Antonio lode had been known for some time, but was not thought to be particularly promising. Tungsten prices were so high that it was worth prospecting almost any kind of a deposit that showed a particle of a tungsten mineral, but Sr. Taborga, at that time a poor bank clerk, had some trouble in raising money enough to operate the claim. Sr. Revoredo was put in charge of the work, with an assurance of salary only if he found ore in sufficient quantity to pay. It was not long before a large bolson of very high-grade ferberite was struck, but it was a pocket only in a mass of siderite forty feet wide. By exploratory work other pockets were found, but no channels, stringers, or other connections between the pockets were ever discovered. Sr. Revoredo's system was to follow one wall of the siderite vein with a drift and then to run crosscuts at short intervals to the other wall.

Near the surface the ore carried a considerable quantity of tungstite that varied in color from light lemon-yellow to deep orange. Some distance below the surface stibnite in considerable quantity was found with the ferberite, so that the ore had to be carefully sorted to make it marketable.

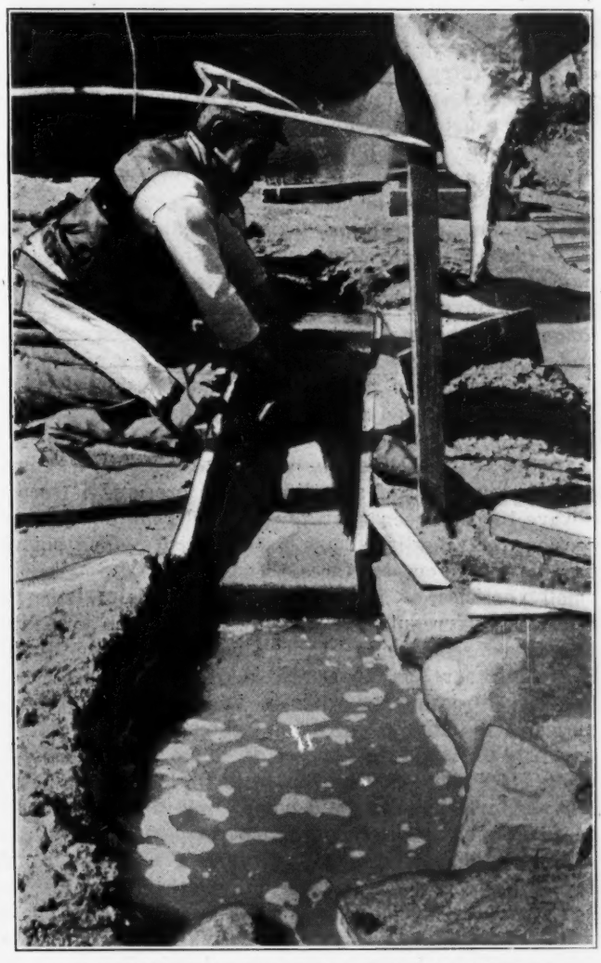
Probably a full million dollars in profit was made from the mine during the war, most of it in the first six months of operation, and from the profits have arisen the best office building in La Paz—a smaller edition of the fine buildings of cities in the United States—and other investments. When operations ceased, little or no ore was left in sight, and whether there are other pockets or not cannot be known without further work.

Without having seen the deposit it is, of course, difficult to form an opinion about its genesis, but some of the analogies suggested by the description as given are striking.

Iron-bearing calcites are known in a number of scheelite deposits—the Atolia deposits make a notable example—and it has been mentioned that ferriferous calcite occurs in the Jorge Quinto deposit and that in depth it seems probable that it may be found in larger quantity. Where iron entirely displaces the lime in the carbonate, scheelite is no longer found, but the iron tungstate, ferberite. The carbonate is ordinarily deposited before the tungsten mineral, and it does not seem too wild a hazard to guess that the ferberite may be a replacement of the siderite, just as scheelite has replaced calcite at Atolia and in a number of the Nevada scheelite deposits.

PACUNI DEPOSIT WORKED BY AN AMERICAN

A fourth tungsten deposit with unusual characteristics is situated at Pacuni, in a magnificent glacial valley on the east slope of the Andes, at about 17 deg. south latitude, sixteen miles northwest of Quimsa Cruz



A "LAVADORE" AT THE ENCARNACION "INGENIO"

(Tres Cruces Pass), and seventy-five miles southeast of La Paz. Until 1920 it could be reached only by mule-back over a trail sixty-five miles long from Eucaliptus, but now an automobile road runs past it to the Caracoles tin camp. This deposit was held during the war by C. Dillon, an American, and a considerable production was made during the reign of high prices. The large glacier that once filled the valley to a depth of perhaps a thousand feet has melted, and only the comparatively small tributary hanging glaciers are now left, like the streams that flow from the mountains in our arid states and are lost in the débris slopes. One of the small glaciers is situated directly over one part of the vein, and at irregular intervals pushes masses of

ice over a precipice onto the trail below. Four or five years ago several men were killed by such a mass.

VETA BLANCA VEIN CARRIES BLACK SCHEELITE

On the north side of the valley tungsten-bearing quartz veins cut quartz monzonite close to its now eroded contact with quartzite. The lower end of the exposed part of the principal vein, known as the Veta Blanca, is at the top of the large débris slope, at an altitude of about 15,500 ft., whence it may be followed straight up the steep mountain side to a height of perhaps 16,300 ft. The vein is about two feet wide, and carries masses of wolframite with scheelite that is nearly as black as the wolframite. The most noticeable mineral in the vein, aside from the quartz, is a green chlorite of the variety prochlorite. The prochlorite seems to be original in the vein, and not a replacement of the country rock. There are places in the vein where the chlorite appears to be a replacement of brecciated granodiorite; however, as none of the granodiorite along the walls is chloritized, it seems probable that the prochlorite of the vein may have been brecciated by later movements. The fact that most of the tungsten minerals are in the prochlorite also seems to indicate its vein formation. Besides the minerals named, the vein carries considerable white apatite, in irregular masses, some of which are two inches in longest dimension; some pyrite; a little chalcopyrite, and at some places a little magnetite and brown tourmaline. Assays of the ore have shown as much as 6 per cent of tin, though some assays show only a small fraction of a per cent; but no cassiterite is visible.

Owing to its black color, no one seems to have known of the occurrence of scheelite in the ore, and it seems always to have been mistaken for wolframite. In thin section, the scheelite shows black particles along planes parallel to the crystal faces. These spots are probably small particles of wolframite, though their shape is exceedingly irregular. The only other black scheelite that I have seen occurs in very small quantity on Monte Solitario, near Las Vegas, N. M. In many specimens the scheelite is intergrown with, and has grown around, pieces of wolframite. In lamp light the scheelite has a purplish tint, and I supposed it to be a fluorite, but when I got the specimen out to daylight there was no hint of purple, and I could not at first think what had become of my specimen of supposed fluorite.

The cleavage of the wolframite and scheelite is, of course, very different. The wolframite breaks with rather broad cleavage faces, and the scheelite in much smaller faces, appearing somewhat hackly, but where the wolframite is finely crystallized this difference is not so apparent; however, the light-colored streak quickly identifies the scheelite.

In the quartz monzonite on each side of the Veta Blanca the feldspars and part of the quartz are replaced by sericite for a distance of three to four feet, giving the rock a dark gray color, and in places it is more or less porous. The vein is regular in its width and dip (nearly vertical), but at one place it is cut off by a replacement lode carrying tin. The ore taken from the vein is said to have averaged 8 per cent WO_3.

In one of the upper drifts three to six inches of ice is frozen on the floor for 125 ft. from the portal, and icicles had grown from the roof to the floor during the summer following its operation. The mountain side is so steep that few beings other than a mountain goat or a Bolivian Indian can wholly enjoy traveling over it, especially during the "tropical" summer, when snow frequently covers the rocks.

Concentration was carried on in much the usual Bolivian way, by first crushing and then passing through jigs, over Wilfley tables, and thence to buddles. The crusher and tables were run by a small water-wheel.

Other veins with somewhat similar characteristics occur on each side of the Veta Blanca, but are smaller. Besides wolframite, black scheelite and prochlorite, one vein carries needles of bismuth carbonate replacing bismuthinite. In the quartz monzonite near the Veta Blanca narrow crevices contain a network of small pyrite crystals, with here and there a crystal or aggregate of small wolframite crystals, distributed with astonishing regularity. They are, however, of no economic importance. The veins are included in the great tract of tin-bearing property taken over by Guggenheim Brothers. They were merely incidental to the property and have not been worked since they were acquired.

CLIMATIC CONDITIONS OF VETA BLANCA DIFFICULT

The altitude is 1,000 ft. higher than that of Mount Whitney, and is trying to North Americans. The climate is cold, snowy, foggy, rainy, and disagreeable. Winds in the winter are very severe, and I was told that in 1919 two men were blown over one of the precipices along the vein and were killed on the sharp rocks below. Food for man and mule, and fuel, must be brought in from considerable distances, and building material, except stone, sticks, mud, thatch, and plaster of paris, comes from the United States or Europe.

The Indian miner has heretofore lived in cold, squalid, muddy misery, lightened or at best temporarily forgotten in flirtations with ethyl alcohol during fiestas, but he is, considering his circumstances, an excellent workman. Better housing, better food, and better clothing will undoubtedly make a better man of him, and Guggenheim Brothers have been furnishing these things for their workmen. When speaking of the Indian it must be remembered that his wife is about as good a man as he himself. She lugs a baby on her back, shovels ore, and cooks their modest stew, and I have seen a ten- or twelve-year old girl carrying the small brother or sister on her back for miles along the trails at a gait that my mule could not equal. The Guggenheims brought in a good doctor, and probably for the first time many of these natives had the benefit of competent medical attention.

The property is about sixteen miles from Quime, a little mountain town situated in the broad, verdant head of a narrow valley at an elevation of only about 10,000 ft. On approaching Quime after a few months in the high, bleak Andes, it appears altogether charming, with its eucalyptus trees and corn fields. After a closer acquaintance, some enchantment due to distance must be admitted, but the climate is fine, even if efforts at sanitation are scant.

For 400 years the trade of Quime and the country beyond has been carried wearily back and forth across the 16,000-ft. Quimsa Cruz Pass, and no wheeled vehicle or modern agricultural implement has reached it, but the Guggenheim auto road is only about ten miles away, and the Marta Company, half way to it, has planned a

five- or six-mile extension of the road to its tin mine, and the little gap of four or five miles left may soon be graded so that that greatest modern civilizer since the telephone, the Ford, will roll down into Quime's cobbled provincialism. During the war Quime acquired considerable note on account of the wolframite mines situated near it.

The mines were all closed, and for that reason I did not examine them, but I saw the most wonderful wolframite crystals from them that it has ever been my pleasure to look upon—groups of crystals 2½ in. long, with apparently perfectly square cross-sections, truncated by single dome faces, all as if artificially polished, and set in groups of clear quartz crystals. Other crystals of fine symmetry reached a size of 2 by 3 by 4 in. I tried in vain to buy some for the United States National Museum, and finally extracted a promise from an owner that he would send me some, for which I left money to cover packing and postage. They have not yet come, but neither have several hundred pounds of specimens that I left for forwarding with the principal commercial house of the country. They may all come, *Poco tiempo.*

Probably the only tungsten mine from which tungstite, the hydrous tungsten oxide, has been shipped as an ore, is that of Easly and Inslee, a day's journey (eighteen or twenty miles—more or less) east of La Paz. This mine was leased to the French government during the war at a high monthly rental, which was scrupulously paid. I did not see the property, but I have seen numerous specimens from it, and have had descriptions from both the owners and the French representative, M. Mollard. The vein was said to be eight inches to a foot thick, and was greatly oxidized. Specimens show large crystals of wolframite cut by numerous flat cavities evidently representing the spaces once occupied by barite crystals. From the vein were taken several tons of tungstite in pieces many of which were larger than a man's fist. No mine anywhere else in the world is known to have produced so great a quantity of tungstite.

Excellent specimens from each of the deposits described were donated by the owners to the United States National Museum, which is building up a collection of constantly increasing value to the miner, engineer, or other student of ore deposits, and probably has the best collection of tungsten minerals to be found in the world.

A New Mode of Prospecting

The faithful work horse and plow seem fast replacing the picturesque burro as a prospecting medium in northeastern Washington. Last Spring, Gust Maki, a farmer near Northport, Wash., while plowing in his field unearthed float boulders of smithsonite (zinc carbonate). He traced these a short distance and discovered a deposit of zinc ore, which in the past year has produced enough ore to make him independent of farming. Now comes Edwin Seaman, a farmer near the town of Valley, in the same county, who has discovered in a similar manner a quartz vein carrying appreciable mineralization in the form of gray copper and chalcopyrite. From rich surface float Seaman has collected nearly a carload of selected samples for shipment. The vein that the plowshare uncovered is now being prospected, and it is reported that it has considerable promise.

The Electrolytic Recovery of Zinc In Tasmania

In the treatment of zinkiferous ores such as the complex ores containing zinc and other metals which are mined in Broken Hill, the electrolytic method of treatment as carried out by the Electrolytic Zinc Co. at Risdon, Tasmania, is becoming more generally applied, and a smaller proportion of zinc ores is now smelted, according to a writer in *Chemical Engineering and Mining Review.*

In the electrolytic method of treatment, the concentrates are first roasted and then leached with sulphuric-acid solution. The residue left after the leaching operation contains a certain amount of zinc, together with lead and other metals, and it has been customary to treat this residue for the formation of fume by mixing the same with a reducing agent, such as coke, and subjecting the mixture to a blast of air on a Wetherill grate or some such suitable furnace. This fume is sometimes sold as a leaded zinc pigment, but is often leached with sulphuric acid to produce electrolytic zinc.

The method of fuming as applied to the residue from the leaching operation has also been applied directly to the ore, either roasted or unroasted.

Various patents have been taken out for processes aiming at the conversion of zinc into fume, and its collection therefrom. In 1904, J. C. Clancy proposed blowing sulphide ore into a highly heated chamber to transform the zinc sulphide into oxide, which would be condensed and leached out with H_2SO_4. In 1907 Hommel and Sulman patented an elaborate process in which the sulphide ore is roasted and mixed with coal and suitable fluxes, placed in a furnace on heated fuel, and air blown through. The zinc is recovered from the condensed fume by leaching with sulphuric acid. J. H. and P. M. Gillies in 1916 proposed to fume lead and zinc, leaching the zinc from the condensed fume with H_2SO_4. Laist, of Anaconda, patented a process in 1917, in which the residues are dried, mixed with fine coal, and smelted to produce a matte, slag and fume containing the lead and zinc, which is collected and leached with dilute H_2SO_4 for the recovery of the zinc.

In all these methods, however, the expensive means of collection by baghouses or electrical precipitation have been involved. Experiments have accordingly been carried out by the Electrolytic Zinc Co. at Risdon with a view to evolving a process by means of which the fumes may be directly leached without the intervention of a baghouse or other means of collecting the valuable constituents of the fume.

The resulting new treatment, which it is planned to put into operation on a large scale, consists in passing fume from the Wetherill furnaces upwardly through a tower checkered with suitable packing to give a large area of contact and to prevent accumulations of the insoluble portion of the fume. Down this tower H_2SO_4 solution (spent electrolyte) is caused to flow against the ascent of the fumes so as to be brought into intimate contact with them, causing the soluble constituents, which consist principally of zinc compounds, to be dissolved in the descending solution, which is run into a receptacle at the bottom of the tower. The solution and solid residue thus collected are treated by known metallurgical methods for the recovery of their valuable metal contents.

War Problems in Minerals

Introductory

BY J. E. SPURR

THE SERIES OF PAPERS which is begun by the article by Mr. Westervelt in the present issue is intended to record a consecutive series of events in the handling of the mineral situation in Washington, during the war, by agencies specially mustered or drafted for this specific purpose, and operating without any agreed or premeditated organization. Although these agencies worked, of course, through fixed and organized Government departments, they availed themselves, for their information, for their powers, and for the scope of their work, of all the pre-war departments and also of the specially created war boards. Even the pivotal point of operations shifted according to opportunism and necessity.

The War Minerals Committee headed by Mr. Westervelt operated under the ægis of the Interior Department, but only semi-officially; the Committee on Mineral Importations had its origin and source of instructions from the Shipping Board, together with the War Trade Board and the War Industries Board; and the subsequently developed unofficial interdepartmental organization trailed between the War Industries Board and the Interior Department, till it centered more and more in the latter; and the post-war aftermath of the campaign rested, of course, with the Interior Department. Yet the files of no one, nor, in fact, of all of these organizations taken together, will afford any consistent report of the story of the effort to regulate the supply of minerals for war purposes during 1917 and 1918. It is a story which should go on record, as part of the history of the mineral industry, and, in our special field, as a record of an important detail of war history, covering a subject which it is still our business to study and to try to solve.

I have felt that the series would be incomplete without articles covering the work of the Geological Survey and the War Industries Board; and I hope to be able to present special papers on these later. Unquestionably, the Geological Survey rendered greater war service as regards mineral policy than any other organization in the Government and outside. The knowledge of the mineral situation which its experts possessed, and their detached judgment as to the preferred mineral policy, was the solid foundation on which rested the decisions and movements of the other agencies which had to deal with the mineral problem. I shall hope that the Director will contribute an article frankly setting forth these facts in detail. The Geological Survey was a bureau, however, possessed with little or no executive authority; and the advent on the field in Washington of various boards and committees suddenly empowered, under the necessity of war, with peculiar and vast executive responsibilities, furnished the combination of special knowledge and executive responsibility which prepared for and justified prompt action on vital problems which came up in swarms for decision.

It is fortunate that those who were then charged with responsibility for action were engineers and geologists, with long-established personal contact with the Geological Survey and the Bureau of Mines, and that all fitted together with the alacrity of war volunteers in no time at all. But it was not an official organization then, and the higher officers of the Government had no conception of how the problem was being handled—and still have not—and this includes to a large degree the heads of the departments and of the war boards. Altogether, while the fundamental idea of these papers was to show the machinery of this rough group of vigilantes, and expose the lack of organization as an argument for a better organization against present and future necessities, yet, after all, looking back, one is finally thankful that it was no worse, as it might easily have been, and that the major problems of mineral supply were solved with at least a fair degree of correctness and promptness and were handled by qualified experts.

The record of war activities in Washington would also be fragmentary without a setting forth of the special and vastly important work of the War Industries Board, most powerful and most responsible organization of all —work which was in charge of Mr. Pope Yeatman and others. I further hope that we may be able to publish a special article on this phase of war mineral history, and setting forth the problem from that vantage point.

In these articles no attempt at co-ordination is made. Each contributor has written his article without consultation or conference with the other. Thus the individuality and the different points of view are left as they exist, and if there is any slight suggestion of Browning's "Ring and the Book," it will not detract from the effort at maximum frankness and clarity and historical value, except in so far as the view is just that the actors in a historical episode are utterly incapable of recording it fairly and accurately; and this we cannot well eliminate.

I.—The War Minerals Committee, 1917-1918

BY WILLIAM YOUNG WESTERVELT

THE WAR MINERALS COMMITTEE was organized early in July, 1917, and was constituted in personnel and representation as shown in the table on the following page.

The need of a war committee to determine the possibility of replacing imported by domestic minerals essential to the prosecution of the war, and to foster such replacement, was realized in the spring of 1917 by Mr. Hotchkiss, who then went to Washington to urge the formation of such a committee. He interested in his proposal Mr. Philip N. Moore, then President of the American Institute of Mining Engineers, and Mr. De Wolf, and, by the combined efforts of the three, the listed national organizations related to the mineral in-

Organization Represented	Representative	Committee Organization
U. S. Geological Survey.....	David White, Chief Geologist	
U. S. Bureau of Mines.....	Alfred G. White, Mines Economist.....	Secretary
Association of State Geologists, Geological Committee of National Research Council	W. O. Hotchkiss, State Geologist of Wisconsin	
American Institute of Mining Engineers, Mining and Metallurgical Society of America.....	William Young Westervelt, Consulting Mining Engineer, New York.....	Chairman
	Harvey S. Mudd, Mining Engineer, Los Angeles...	Assistant Secretary
	F. W. DeWolf, State Geologist of Illinois.....	Alternate to W. O. Hotchkiss

dustry of the country became interested and nominated their respective representatives. Subsequently, Mr. Mudd, who volunteered to come from Los Angeles to Washington for service, was appointed Assistant Secretary.

The first work of the committee consisted in receiving reports of mining engineers and geologists of the Geological Survey, of the Bureau of Mines, of its own members, and of others in private practice, as to the possibility of stimulation of domestic production of the principal imported minerals to meet the usual and war needs of the country. From these, and from subsequent examinations and reports made expressly for the committee, it was evident that, having due regard to the time required for domestic mineral development, a very considerable tonnage of deep-sea shipping could be made available, for the all-important transportation of munitions to Europe, by gradually withdrawing shipping from mineral importations. The largest ship tonnage so available was found to be employed in the importation of sulphur as pyrites. It was also found that by adaptation of steel metallurgical practice to meet domestic ore limitations, accompanied by sufficient development of domestic sources, a somewhat lesser ship tonnage might be secured by withdrawal from manganese ore importations. A still smaller ship tonnage, it was found, might be secured by withdrawal from the importation of ores of chrome and other minor minerals.

By this means not only could shipping, of which the Allies stood in such dire need, be secured, but the United States could be made just that much more self-sustaining in case of long-continued success of the German submarine campaign. The Council of National Defense, the Shipping Board and the mining public were accordingly advised of the circumstances, urged to increase domestic production of these minerals wherever economically practicable, and to allocate the steadily dwindling, high seas shipping with these facts in view.

But as the work of the committee progressed, the necessity became more and more evident of a legally constituted central authority capable of understandingly adjusting to mining and metallurgical needs the ever-increasingly drastic war effects on labor, supplies, and transportation, manifested through the purchasing and commandeering powers of the Army and Navy. If the war was to be indefinitely prolonged, as then seemed to all possible or even probable, power to appoint and the necessity of appointing some great captain of the mineral industry as Minerals Administrator became more and more apparent. Provision of funds and authority for the Government to stimulate the development of feasible but ordinarily unprofitable domestic deposits of heretofore necessary imports was also advisable.

Accordingly, after consulting with various authorities, including Mr. Hoover, who was by then well started on his brilliant demonstration of what a proper war administration can accomplish in fostering and developing a great basic industry, the committee became convinced that a War Administration law should be secured as quickly as possible. No other means offering, the committee itself drew up a War Minerals Administration Bill, including all minerals and the products therefrom (other than fuels, which had already been provided with an administrator), and submitted it to the Mines committees of the United States Senate and House of Representatives.

From then on the committee devoted itself primarily to securing support for this bill, which, after considerable modification to meet various views of those concerned, was finally enacted into law the following autumn.

One of the most important features of this legislative work of the committee consisted in getting the situation sufficiently clearly before the membership of the national mining, metallurgical and geological societies to secure their indorsement; an indorsement unstintingly and most effectively given as soon as the situation was clearly understood.

The indorsement of the Army, of the Navy, of the Treasury Department, of the Department of the Interior, of the Council of National Defense, of the Food Administration, and finally of the President himself had also to be secured, the committee working largely through its bureau connections in the Department of the Interior.

The interest of the non-technical leaders of the mining industry was also sought and ultimately gained. But being keenly alive to the necessity of limiting as much as possible governmental interference with business conditions, at first these leaders were inclined to oppose the bill as more likely to increase than to desirably modify Government influence. To meet this objection the major mineral industries were dropped from the bill, for, though regretting it, the committee felt it futile to delay the passage of the bill by attempting to avoid this omission and was convinced that the imperative need was the appointment of a suitable Minerals Administration under whatever conditions were practical. A mining man was felt to be needed in the high councils of war, of such knowledge and eminence as, when given authority, he would be able so to modify the inevitable regulations and restrictions of war to the essentials of mining and metallurgical industries as would best fit these industries to support the war and to emerge therefrom reasonably ready for peace.

As the inevitable welding of the entire nation into one gigantic war machine began to be more obvious with the prolongation of the war, it was believed that each specific mining industry would seek and would then through this Minerals Administration receive, in the high councils of war, recognition of its necessities for proper development under both war and subsequent peace conditions. In fact, short though the war was after America's entrance on the battlefield, and though the War Minerals Bill became law too close to the time of signing the Armistice to admit of even final determination of the personnel of the Minerals Administration, some of the industries that had been omitted from the bill at their own request were already moving to be included under its protection. The situation, as summarized in a letter written in May, 1918, by the chair-

man of the committee to the members of the Mining and Metallurgical Society of America, was:

"Though this bill grants no powers over any but the minor minerals enumerated therein, I believe it offers the best opportunity the mineral industry is likely to have of securing adequate representation in the high councils of the War Administration. With our transportation and fuel supply in the hands of Government, and with labor and supplies all rapidly coming under Government control, do you not agree that it is most urgent that we quickly secure the appointment of some prominent member of our profession to such high position in the Government councils as would be held by a Minerals Administrator? Some one in constant attendance at Washington must be in a position to see to it that the Government control necessitated by the war is directed toward fostering rather than suppressing the mineral industry, or the war itself may be lost through lack of essential raw materials."

With the signing of the Armistice, practically immediately after the passage of the War Minerals Administration Bill, the work of the War Minerals Committee, like that of all other purely war activities, automatically ceased.

From the beginning, the committee was greatly assisted by its sponsor organization. The Government bureaus supplied quarters, organization, services of government engineers, and other facilities in Washington, and the National Societies supplied funds, publicity of the committee's needs through their publications, and services of officers and members. In all instances response to requests to members of the profession for services, information, and assistance was unstinted as soon as the need for war purposes was made plain.

Directors Smith and Manning, of the Survey and the Bureau respectively, promptly sent their various experts on matters in hand to report both verbally and in writing to the committee, and, in so far as was feasible, both directors relieved their respective representatives to the committee of other duties during the more confining part of the committee's work. In spite of their best efforts, however, the Government members of the committee inevitably gave a large amount of time to the committee's work under conditions which meant spending a corresponding amount of overtime attending to essential parts of their regular responsibilities. The other members of the committee, being in Washington exclusively for the purpose, were able to give their entire time while there to committee business, but being unable entirely to neglect their responsibilities as private engineers, could not be in Washington continuously, as were the Government members. Between the two classes of members, however, the committee was able to function fairly consecutively so long as the work so necessitated, and Mr. Mudd, entirely abandoning his private practice, moved to Washington and devoted himself exclusively to the work of the committee until after the signing of the Armistice.

In response to a general appeal, many private engineers sent in reports on mining prospects in which the committee might be interested, thus supplying much valuable data. At the instance of the committee, special examinations of various properties were made gratis by various prominent engineers, among whom might be mentioned Messrs. J. Parke Channing, F. Lynwood Garrison, J. E. Johnson, Jr., James W. Malcolmson, Philip N. Moore, J. H. Rogers, and others.

Idaho Bureau of Mines Issues a Bulletin on "Testing Ores For Flotation"

The Bureau of Mines and Geology of the State of Idaho has recently issued Pamphlet No. 3, "Testing Ores for Flotation," by A. W. Fahrenwald. In preliminary testing work, it is recommended to grind from 75 to 100 lb. of the ore to pass 65 mesh. Wet grinding in a small ball mill is advised, inasmuch as it gives 5 to 10 per cent better recoveries and grades of product than dry grinding. After the best conditions for the treatment of the original sample have been determined, other samples should be ground to pass 48, 100, and 200 mesh for further testing to determine the degree of fineness desirable.

Flotation testing machines should conform to the following specifications:

1. The capacity should be not less than 500 g., preferably 1,000.
2. They should be capable of being easily charged, discharged and cleaned.
3. They should preferably be of the centrifugal impeller type, which allows the aeration to be controlled, and makes easy the use of gases such as SO_2 and H_2S.
4. The sides should be of glass to facilitate the observation of results.
5. There should be no circulation pipes.
6. The impeller shaft should enter from the top.

After adding a 1,000 g. sample to the machine, it is diluted with 1 liter of water, and the controlling agents added, if used, followed by the flotation agents. After thorough mixing, the pulp level is raised to within 2 in. of the overflow lip and the removal of the flotable minerals is effected by agitation and frothing. This should last from three to twenty minutes, depending upon the character of ore being tested. Testing work is usually done with a pulp dilution of 4 of water to 1 of dry solids, but other dilutions should be tried. Low pulp dilution, 2.5 or 3 to 1, is usually best for differential flotation.

Among flotation agents, all of the pine oils are good, steam-distilled being among the best. Pine-tar creosote and wood turpentines are used a good deal, as are hardwood creosotes. Coal tars are used in conjunction with pine or other frothing oils. Coal-tar oils lower the surface tension of water less than the more soluble pine oils and therefore require more agitation and mixing. Hardwood oils have a low oil-water interfacial tension and spread rapidly on water. They are exceptionally good flotation agents for this reason.

Sulphuric acid, salts, or alkalies may be used as controlling agents. Small amounts of the acid are often beneficial in keeping down the percentage of gangue in the concentrate. The kind of controlling agents to be used and the amounts depend entirely on experiment and experience. Also the time of agitation with the controlling agent is of great importance, and tests should be made in which this time is a variable, especially in differential flotation work.

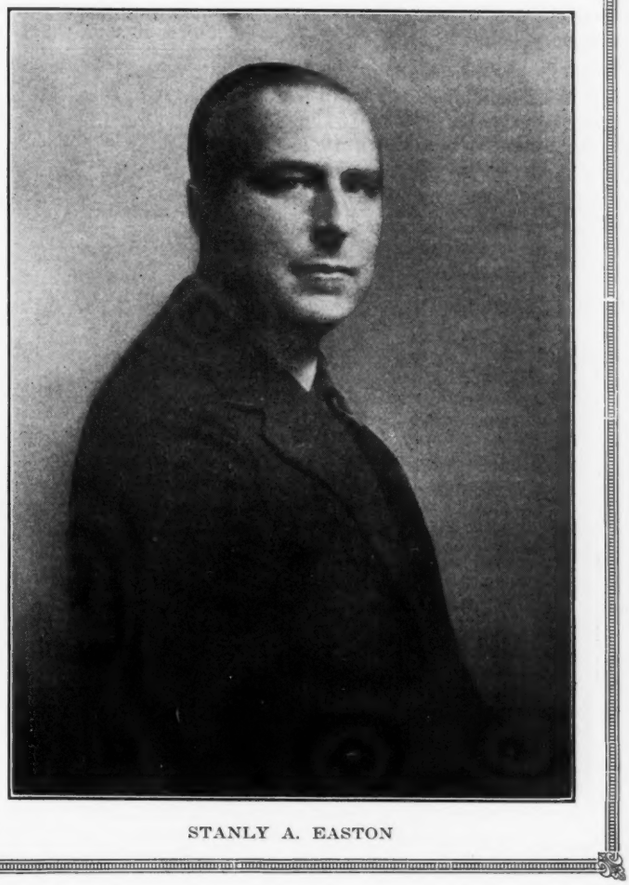
The time required to remove all of the mineral should be noted, as this will give an idea of the number and length of cells necessary in large-scale work.

If testing be done with care and knowledge of the influence of all details and factors, the test results can almost always be duplicated in a mill, in the opinion of the author.

Mining Engineers of Note

Stanly A. Easton

IN SEEKING Stanly Easton at Kellogg, Idaho, one is most likely to find him in the mine, in the mill, or in the mine surface plant talking over some detail of the work with one or more of his men. You are impressed, whether you meet him thus or back of his desk in the main office of the Bunker Hill Mining & Concentrating Co., with the fact that he is on the job. As a mine manager, he is in intimate touch with his staff, foremen, and workers and with the operation as a whole or in detail. Mr. Easton's parents were California pioneers from New England. His mother was Mary Esther Gushee. Her father came to California in 1848 by way of Vera Cruz and Mexico. Mr. Easton was born at Santa Cruz, Cal., and was fortunate in establishing a connection with the mining industry early in life. His first employment was as an office boy for Hans C. Behr and W. I. Salkeld, a firm of engineers engaged in mechanical and mining engineering in San Francisco. They were prominent in mill and hoisting-plant construction in Virginia City, Nev., at the time. Hans C. Behr became internationally known in mine hoisting and mechanical engineering of mines. From office boy young Easton was advanced to the field, and in construction work had his first opportunity of getting in intimate contact with the many activities in mining current at that time.



STANLY A. EASTON

With this opportune acquaintance with the industry he entered the college of mines of the University of California, and was graduated from that institution in 1894. On leaving college, Mr. Easton made for the nearest mines and found employment underground at gold properties in Calaveras and Tuolumne counties where he was known, having previously spent his vacations there. The usual run of miscellaneous work was encountered, such as assaying, mining, and mill and construction work. In 1896 he went to the Northwest and enlarged his experience by working underground in western Montana, Rossland, B. C., and in the Coeur d'Alenes. In the last-named place he was employed as a miner in the winter of 1896-97 at the Bunker Hill & Sullivan. Whether he visualized his future connection with this famous mine at the time is not known, but subsequent events no doubt made this preliminary experience exceedingly valuable.

His next experience was in charge of productive mining work at Silver City, Idaho, in 1897, and in 1899-1900 he had charge of development work at Greenwood, B. C., and afterward at Republic, Wash. With six years of valuable experience, he engaged in mine examination work (1901-1902) under F. W. Bradley and with the late Capt. J. R. De Lamar's corps of engineers. Mr. Bradley was impressed by the ability and character of the young man, who had become a valuable assistant, and placed him in charge of the Bunker Hill & Sullivan properties when Albert Burch resigned. Since Jan. 1, 1903, Mr. Easton, under Mr. Bradley, has been in direct charge of all operations, and both of these men have consistently developed and equipped the property, with the result that since that time over $24,000,000 has been disbursed as dividends and over $4,000,000 of earnings returned to the property in betterments and extensions of operations. T. A. Rickard's history of the Bunker Hill enterprise is a complete account of this important property worthy of the attention of both engineer and mining student.

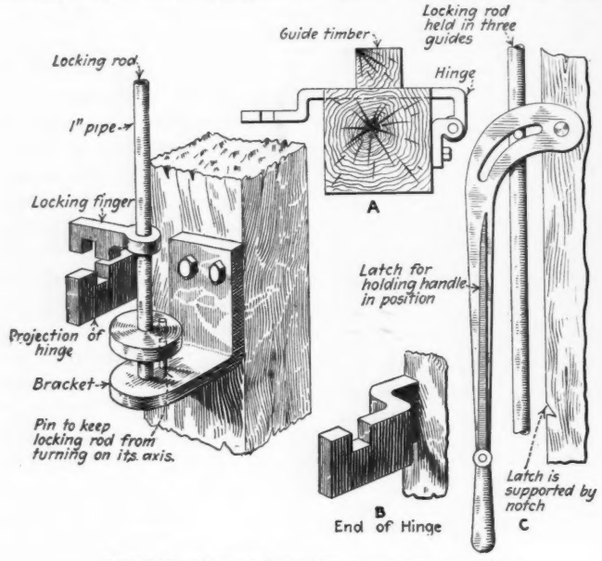
Despite the exacting requirements of his present position Mr. Easton has found time to engage in consulting practice and has directed five lesser but highly profitable operations in the Coeur d'Alenes. He was married on Nov. 15, 1906, to Estelle Greenough, of Missoula, Mont., and there are three children. Mr. Easton has energized the Idaho Mining Association and has been exceedingly helpful to young engineers. His ability as a leader has not been overlooked, for he is a director in the American Institute of Mining and Metallurgical Engineers at present and has been a director in the Mining and Metallurgical Society, president of the Boy Scouts, and of the Idaho Mining Association. He is a member of the Idaho State Board of Education and holds at present the position of chairman of the executive committee of the Board of Regents of the University of Idaho.

HANDY KNOWLEDGE

Locking Hinged Guides

Written for *Engineering and Mining Journal*

Skips and cages are removed from the shaft compartment in most instances by providing hinged guides for each compartment at a convenient height above the collar of the shaft. The length of the hinged guide section is determined by the distance between the lower and upper skips or cage runners, plus 2 or 3 ft. for clearance. The guide section is bolted to two, three, or four heavy hinges, which are forged from ½ x 4-in. or ¾ x 4-in. wrought iron and securely bolted to the timbers. The securing of the hinges when the guides are in running position is worked out in various ways. One of the simplest methods is the hasp and pin. This answers for a short section of guide, but at best is inconvenient and wasteful of time. A device for locking the hinges in place has been worked out at the Plymouth Consolidated Gold Mines, at Plymouth, Cal., and is used at the main shaft of the mine.



DEVICE FOR LOCKING HINGED GUIDES

A—Horizontal section through guide timber. *B*—Detail of device. *C*—Handle for lifting locking rod.

The moving blade of the hinge is extended and a square notch cut into it. A locking finger attached to a vertical 1-in. pipe engages the notch on the blade of the hinge. The locking rod is sufficiently long to carry a locking finger for each hinge on a guide section. Near the end of the locking rod is a collar which rests upon the lower bracket and supports the weight of the rod and its attachments when the hinges are locked in position. To keep the locking fingers in proper position a guide pin is screwed into the lower collar, as shown in the illustration. The rod is held at the top, middle, and bottom by brackets, which prevent it from buckling. To lift the locking rod an ingenious handle operating on the principle of the cam is provided. This is shown at *C* in the figure. *A* is a horizontal section through the guide timber. Each hinged guide section is provided with a locking rod and operating handle.

Device for Indicating Hoisting Level

Written for *Engineering and Mining Journal*

At the Kennedy mine, Jackson, Cal., the device shown in Fig. 1 is used to indicate to the hoisting engineer the level from which hoisting is to be done. The arrangement consists of a vertical board attached by brackets to the vertical timbers supporting the guides above the shaft collar. The numbers of the levels are painted in large figures upon the board. A pointer attached to a cable is moved up and down by a hand wheel, thus indicating the level to the engineer.

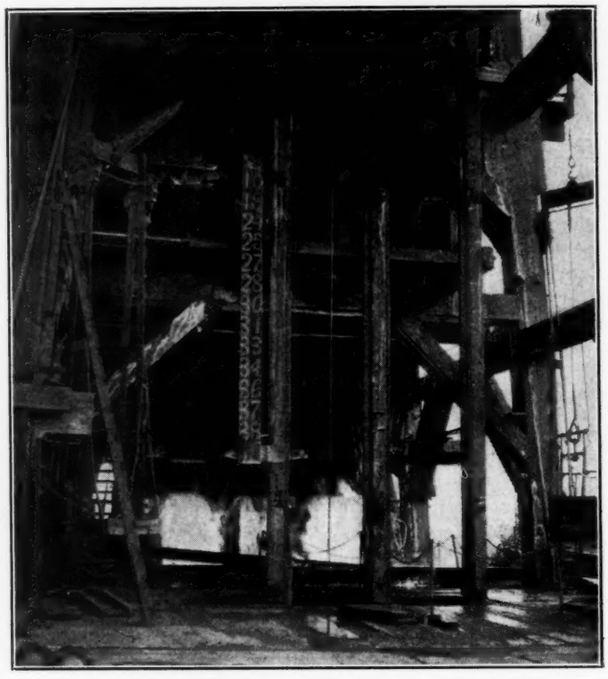


FIG. 1. DEVICE USED AT KENNEDY MINE, JACKSON, CAL., TO INDICATE HOISTING LEVEL

At the Argonaut mine the shaft level is shown to the engineer at the hoist by a series of boards, each one of which is numbered in accordance with the level indicated. The boards are strung upon two rods in two rows in a position convenient to the top man and within view of the hoisting engineer. Levels are indicated to the hoisting engineer by swinging the board down as shown in Fig. 2. At several other California mines electrical devices are used.

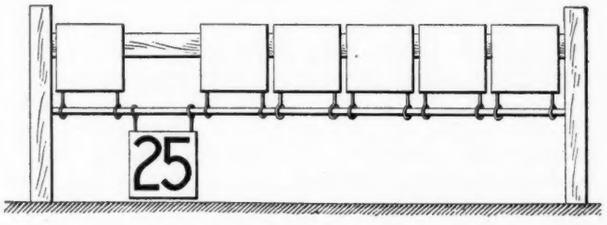


FIG. 2. DEVICE FOR INDICATING HOISTING LEVEL USED AT ARGONAUT MINE, JACKSON, CAL.

THE PETROLEUM INDUSTRY

Fort Norman Oil Supplies Local Demand

SPECIAL CORRESPONDENCE

A market has already been found for the oil produced by the Imperial Oil Co. at Fort Norman. There is an active demand all along the river for gasoline for motor launches and motor-propelled scows, and officials at the well have been overwhelmed with applications for supplies, which they were generally unable to meet, as only a few drums had been distilled by a primitive apparatus. Gasoline sells for $2 per gal. along the river at the northern posts, and traders, trappers, and all who engage in river transportation are looking for a reduction in price as soon as any appreciable local supply is available.

G. P. Kells has a force of men erecting gasoline storage tanks and a modern gasoline distillation plant. Five tanks of 4,500 gal. capacity each will be erected. The distillation plant has a capacity of from 150 to 200 gal. of gasoline per day, and it is expected to be operation in a few weeks.

Oil Obtained by Shaft in Estill County, Ky.

SPECIAL CORRESPONDENCE

In Estill County, Ky., where the oil industry of the state started, a method[1] of taking crude oil from the ground, which is designed for areas where shallow wells have been pumped out, is being tested.

The method consists of mining the oil, and is being tried out by D. W. R. Kinney, a former Montana gold miner. There is a growing expectation among those who have watched his work that the attempt will be an entire success.

Mr. Kinney began operations last May, and now has a shaft 8 ft. x 12 ft. sunk to a depth of about 135 ft. This is lined with timbers and cement. Stairs have been built all the way down to the cap rock. At that point the shaft penetrates the oil sand, and there is a production of four or five barrels a day.

It is Mr. Kinney's intention to continue through the oil sand, and when he has again struck a solid stratum, to enlarge the shaft, thus forming a pit into which oil will drain from the oil sand above.

To Begin Oil Drilling in Cochise County, Ariz.

SPECIAL CORRESPONDENCE

Under the terms of an agreement with a well-drilling company of Yuma, Ariz., drilling will begin within ninety days for oil in the Mescal Gap district, twenty miles from Tombstone. Leases have been secured on 5,055 acres of land.

Many geologists have examined the district, and all agree it is favorable for oil prospecting, with indications that oil will be struck from 2,300 ft. to 2,500 ft. The company has agreed to drill to this depth, and, should indications warrant, will go further.

[1This method follows the general plan which has been used in the Pechelbronn (Alsace) oil mines.—EDITOR.]

Oil Concessions on Dead Sea To Be Drilled

WASHINGTON CORRESPONDENCE

Inquiry by the Department of Commerce into reports that discoveries of oil have been made in the vicinity of the Dead Sea, in Palestine, develops the fact that though traces of oil have been found in that vicinity, there are no producing wells. A New York company, however, is preparing to drill on a concession near the southwestern edge of the Dead Sea. Because of the broken character of the country and the hostile attitude of the Bedouin tribes, little prospecting has been done on the east side of the Dead Sea, but bitumen is collected in small quantities from the surface of its waters. Before the war, about fifty tons of this material was sent to Germany, where it was used in the glazing of patent leather. Limestone shales impregnated with oil are found on the northwestern coast of the Dead Sea and in the Yarmuk Valley.

Petroleum in Poland

WASHINGTON CORRESPONDENCE

Poland is well on the way to economic independence, in the opinion of the Department of Commerce. A survey of economic conditions in that country shows that the production of coal is now approximating the prewar rate. With regard to the petroleum situation in Poland, the report which was made public Sept. 12 says: "The production of crude oil, another important mineral product of Poland, also fell nearly one-third during the war. As two or three years are required to complete new wells, the production has not begun to recover, but the number of wells in process of drilling has increased materially. The refineries are now in position to handle all the oil produced, and exports of the finished product are rapidly increasing. They amounted to more than 200,000 tons in 1920."

Wireless in Canadian Oil Field

SPECIAL CORRESPONDENCE

In reply to a demand by O. S. Finnie, acting secretary for the Northwest Territories of Canada, for a system of wireless communication in the oil fields, A. H. Morse, of the Marconi Wireless Co., has issued a statement showing that the responsibility for delay in the matter does not rest with the company. The latter, he says, has studied the situation at Fort Norman for several months and got together five complete sets of modern wireless equipment, and by Aug. 16 had everything ready for the establishment of a chain of five stations. It applied to Ottawa for licenses to proceed with the installations, but as the licenses had not been granted the company was unable to carry out the scheme, and even should the licenses be received the season is now so late that nothing can be done this year.

MEN YOU SHOULD KNOW ABOUT

Arthur B. Foote, of Grass Valley, was recently in San Francisco.

Lindsay Duncan, of San Francisco, has returned from Tacoma, Wash.

H. A. Guess has returned to New York from a trip to the Northwest.

Charles A. Roger has returned from Chile, and has gone to Salida, Col.

F. E. Briber is with the Utah Consolidated Mining Co., at Bingham, Utah.

Tallmadge Kyner, of Denver, is making examinations in the Lordsburg, N. M., district.

R. A. Bryce, of Toronto, has returned from an examination in the Kirkland Lake gold area.

Dorsey Lyon, of the U. S. Bureau of Mines, has returned from Alaska and is in San Francisco.

H. Foster Bain will be in Berkeley, Cal., Oct. 3 and will leave for Bakersfield, Cal., Oct. 6.

L. H. Goodwin is temporarily at Absecon, N. J., for the Allis-Chalmers Manufacturing Co.

Fred B. Ely is leaving Arizona to make extensive examinations for oil and gas in western Mexico.

Sir Robert Borden, former Premier of Canada, has been appointed a director of the British American Nickel Co.

Jay A. Carpenter has accepted the professorship of mining at the South Dakota School of Mines at Rapid City, South Dakota.

E. Horton Jones, formerly chief engineer of the International Nickel Co. at Copper Cliff, Ont., is in New York City for two weeks.

E. M. Sawyer, general manager of the Phelps Dodge Corporation, Burro Mountain Branch, is in New York and the East on a vacation.

Stuart Croasdale & Co., mining and metallurgical engineers, announce the removal of the Pittsburgh offices to 946 Union Arcade, Pittsburgh.

William H. Emmons, professor of geology, University of Minnesota, was recently in San Francisco en route to Minneapolis from China.

R. A. Hardy, manager of the United Comstock Mines Co., operating at Gold Hill, Nev., has returned from a several weeks' business trip to Alaska.

Alan M. Bateman, of the Department of Economic Geology of Yale University, has returned to New Haven from professional work in Alaska.

Arthur Murphy, of the Ash Peak mine, Duncan, Ariz., has gone to the Pacific Coast on business in connection with the construction of a new mill.

Sam P. Hodgson, geologist, has left the Hanover-Bessemer C. & I. Co. to become mining engineer with the Albuquerque & Cerrios Coal Co. at Madrid, N. M.

M. H. Foss, who has recently been directing mining operations near Idaho Springs, Col., is now in New York. Mr. Foss will soon go to Michigan.

D. M. Bacon, of St. Augustine, Fla., who has been the agent of the Cleveland Iron Mining Co. on the Marquette iron range, is paying a visit to the Lake Superior district.

C. Q. Schlereth has resigned as general superintendent of the mining department of the Cia. de Minerales y Metales, at Monterrey, N. L., Mexico, and will return to Denver.

M. J. Kirwan, petroleum engineer, and **F. X. Schwarzenbek**, assistant petroleum technologist, of the Bartlesville station, are investigating underground conditions in the Deaner field in Oklahoma.

Tudor S. Rodgers has resigned his position of chief chemist for the Tecopa Consolidated Mining Co., of California, to engage in the practice of mining law under the firm name of Rodgers & Rodgers, with offices in Salt Lake City.

Charles W. Goodale, head of the safety department of the Anaconda Copper Mining Co., and president of the Barnes-King Development Co., will represent the Butte district at the National Safety Council at Boston.

L. C. Graton, of the Department of Geology, Harvard, and **B. S. Butler**, of Calumet, Mich., have been carrying on a special geological investigation in Cobalt to determine if any relationship can be established between the deposits of native copper in Michigan and native silver in Cobalt.

Arthur J. Hoskin, mining engineer of Colorado, has recently taken charge of coal-mining investigations under cooperative agreement with the University of Illinois, the U. S. Bureau of Mines, and the State Geological Survey. His address will be 214 Transportation Building, Urbana, Ill.

R. H. Elliott, Pacific Coast manager for the Metals Exploration Co. at San Francisco, which is the parent company of the United Comstock Mines Co., at Gold Hill, and the Gold Canyon Dredging Co., operating a dredge near Dayton, has been in Gold Hill and Dayton during the early part of September inspecting operations.

Dean W. R. Appleby of the Minnesota School of Mines has returned to Minneapolis from a three-months' trip through Japan, Korea, and Manchuria. Dean Appleby headed a party of mining engineers, consisting of **Dr. W. H. Emmons, W. H. Crago, L. D. Davenport, Frank Hutchinson**, and **W. J. Mead**, who were engaged by the South Manchuria Railway to investigate coal and iron-ore deposits.

Mining engineers and metallurgists recently in New York included: **Abbot A. Hanks**, San Francisco, Cal.; **Richard H. Catlett**, Boston, Mass.; **Alfred G. Wilson**, Ottawa, Can.; **John E. Hodge**, Minneapolis, Minn.; **R. T. Wilder**, El Paso, Tex.; **Alexander D. Harvey**, Boston, Mass., and **Joseph L. Rosenmiller**, Oklahoma City, Okla.

SOCIETY MEETINGS ANNOUNCED

The Mining Section of the National Safety Council, which meets at Boston Sept. 26 to Sept. 30, has arranged the following program of papers:

Monday—"Storage Battery Locomotives," by Charles E. Stuart, E. V. Daveller, and R. E. Renz; "Trolley Locomotives," by Frederick W. Whiteside; "Animal Haulage," by E. L. Solomon and R. M. McGraw; "Block Signal and Dispatching Systems," by R. T. Murrill; "Compressed-Air Haulage," by Guy J. Johnson.

Wednesday—"Mine Fire Prevention and Fire Fighting; Anthracite Mines," by H. H. Otto; "Bituminous Mines," by Joseph W. Reed; "Metal Mines," by H. M. Wolflin.

Thursday—"Maintaining Interest in Safety; Among Executives," by M. H. Moulton and William Connibear; "Among Foremen and Shift Bosses," by Thomas Copperswaite; "Among Miners," by J. T. Bradley; "Observations of a Safety Engineer in Various Coal and Metal Mining Camps of the United States," by C. L. Colburn.

Friday—"First-Aid Stations Underground," by Dr. R. R. Sayers; "Provisions for Drinking Water," by B. C. Yates; "Traveling Ways and Signs," by R. H. Seip.

OBITUARY

O. B. Warren, president of the Meriden Iron Mining Co., and one of the best-known mining engineers on the Minnesota ranges, died at the age of fifty-one years, after an operation for appendicitis, at Minneapolis on Sept. 16.

Captain Marcus L. Fay, aged seventy-two, one of the best-known mining men in the Lake Superior district, died recently at his home in Duluth, Minn., of heart failure.

Mr. Fay was widely known as an authority upon both the technical and operating side of mining. At the time of his death he was president and treasurer of the Tesora Mining Co. and president of the Fay-Cananea Copper Mining Co.

Joseph Hotchkiss Harper, founder of the firm of Harper & McDonald, and long prominent in Butte as a mining engineer, died recently at Shelby, Miss., at the age of seventy-six. In 1874 he erected the smelter at Glendale for the old-time Hecla Consolidated Mining Co., and in 1884 he laid out the town of Anaconda and the first smelting and concentrating plant there for the Anaconda interests, under the direction of Marcus Daly, then the ruling force of the Anaconda. In 1916 he published "Harper's Hydraulic Tables," a work well known to engineers. He was connected with a number of engineering projects of prominence and importance in Montana.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

At Washington, the Department of Commerce has been gathering data on conditions of unemployment throughout the country, and a brief survey of the situation in the various mining districts is given in this issue. In Ontario, the Kirkland Lake Gold Mining Co. has announced a reduction in wages, this company being the first gold producer to take this step in the province. The improved price of foreign silver is causing the operators at Cobalt to be more optimistic.

In Colorado, the Interstate Commerce Commission has ruled in an action brought by the Gold Hunter company, of Mullan, Idaho, that the Rio Grande railroad should base its freight charges for carrying ore and concentrates on the net value of the shipments rather than the gross value. At Butte, it is rumored that there may be a resumption of mining activity on a more or less limited scale before long. Considerable activity in the gold district of southwestern Oregon is reported. Another incident connected with the history of the Dolly Varden mine, in British Columbia, is a suit recently brought by George Wingfield, of Reno, Nev., against the Taylor Engineering Co., in which action the property is involved.

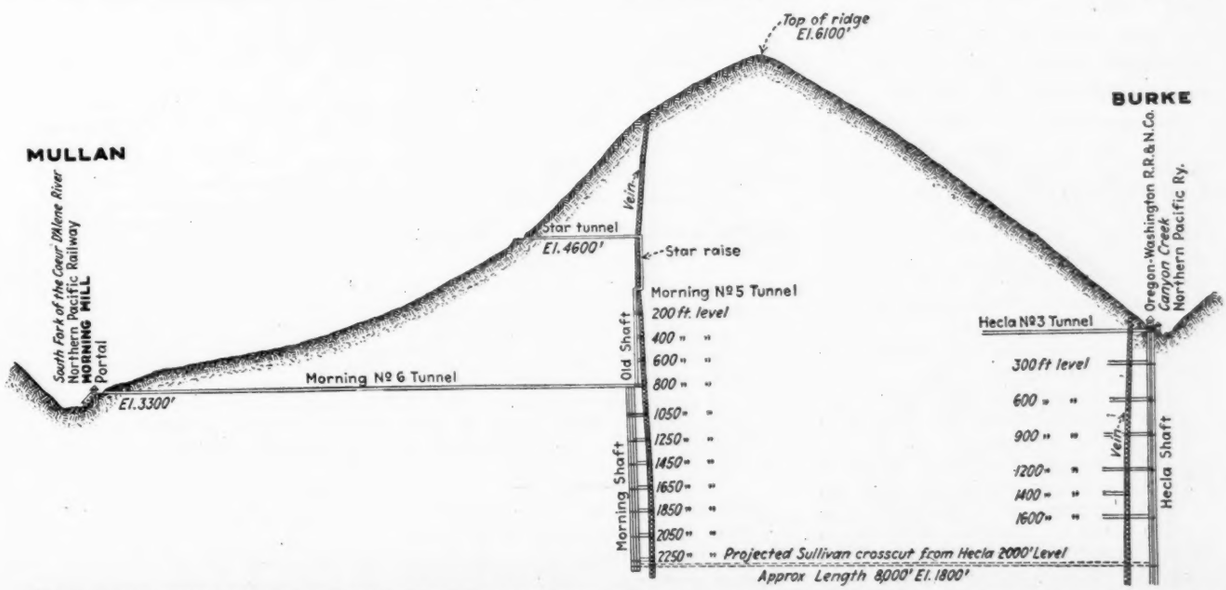
The Proposed Operation of the Star Mine

Cœur d'Alene Property, Under Joint Control of Hecla and Bunker Hill Companies, Will Give District a New Important Producer

THE MOST INTERESTING as well as the most important mining enterprise that has been undertaken in the Coeur d'Alene district in many years is the development and operation of the Star mine by the Bunker Hill & Sullivan Mining & Concentrating Co. and the Hecla Mining Co. It is interesting and significant because the joining of these two big companies in the operation of the Star means a closer affiliation between them in the matter of policies affecting the district. The importance of the enterprise lies in the fact that it will add another great producing mine to the district at a time when such an addition is needed, and also involves the construction of an electrolytic zinc plant by the Bunker Hill & Sullivan company for the treatment of Star zinc-lead ores.

The ownership of a part of the Star orebodies was the issue in extended litigation a few years ago with the Federal Mining & Smelting Co. (Morning mine), the result of which was favorable to the latter in the trial court, but the decision was reversed in favor of the Star by the U. S. Court of Appeals. The work done by the Federal company, which precipitated the litigation, and the large amount of development by both companies in preparation for the trial, together with the large ore shoot exposed by the Star company in its original workings independent of that in litigation, has combined to prove the great value of the Star mine. The enterprise in which the Bunker Hill and Hecla have joined is therefore free from the usual risk of mining, for the Star orebodies have been proved, and it is now simply a question of placing the mine on a productive basis.

Operations at the Star will be conducted under the name of the Sullivan Mining Co., all the stock of which is held by the Bunker Hill & Sullivan and the Hecla, half and half. The plan for reaching and handling the Star ore is out of the ordinary, and presents a fine example of modern mining engineering and the possibilities of deep mining operations. The accompanying sketch, hastily prepared by one of the engineers of the Sullivan Mining Co., gives at a glance a vivid conception of this great enterprise. This sketch gives a cross section of the mountain range un-



ELEVATION SHOWING RELATION BETWEEN MORNING, HECLA, AND STAR WORKINGS. CŒUR D'ALENE DISTRICT, IDAHO. THE SULLIVAN MINING CO. IS TO OPERATE THE STAR MINE.

der which the crosscut is being projected approximately 8,000 ft. to the Star vein. The Star joins the Morning on the west, and the position of the vein, which is identical with the Morning, is shown in connection with the various Morning levels.

The Star orebody has been proved from the Star tunnel on various levels down to the 1,450 level of the Morning, a vertical distance of 3,150 ft. The crosscut will reach a maximum depth under the peak of the mountain of 4,300 ft., and the depth at the intersection of the vein will be 3,800 ft. beneath the apex. Starting from the 2,000 level of the Hecla, the crosscut will maintain a straight course to the objective point in the Star ground. A skip pocket has been completed at the bottom of the Hecla shaft which will hold 1,000 tons, and actual work in the crosscut is now under way. Work will be pushed with all possible speed, and it is expected that it will be completed within two years.

One of the problems in connection with the crosscut is the disposition of the muck. It will be hoisted to the surface and deposited in a great bin that has been constructed for the purpose and which discharges into No. 3 tunnel level, through which it will be trammed back and used for filling in the workings of the Hecla mine. A large amount of the waste can be disposed of in this manner and to the advantage of the Hecla, and when this plan is no longer available, it is probable that the remainder will be hauled away by the railroad company.

The possibility of cutting other valuable mineral-bearing veins before the Star ground is reached is another feature of this big enterprise that lends special interest. Leaving the Hecla ground, the crosscut will pass through the Omaha, Thisbie, Midway Summit, and Flynn groups of claims, all of which have great prospective value, and, with the exception of the Midway Summit, are now in process of development.

Kirkland Lake Gold Mining Co. Announces Wage Cut

The first step to reduce wages at any of the gold mines of northern Ontario was taken recently when the Kirkland Lake Gold Mining Co. announced a reduction in wages of 50c. and 75c. a day, the reduction to take effect the second week in October. The result of this action will be followed with considerable interest, as the gold-mining industry of northern Ontario is practically the only one in the province which has not cut wages.

It is quite probable that other operators at Kirkland Lake will also make a cut, and it will not be at all surprising if a similar action is taken at all the gold mines within the next two or three months. In addition to helping the operating mines, a reduction in wages would have a noticeable effect upon the amount of work being done by the small non-producing properties, and would result in a large amount of development work throughout the country.

Electrolytic Zinc Co. Makes Contract

(Cable by Reuters to "Engineering and Mining Journal")

Melbourne, Sept. 19—The Electrolytic Zinc Co. of Australasia has completed a contract with the British Board of Trade for the purchase of 750,000 tons of concentrates and slimes.

Broken Hill to Resume Production

(Cable by Reuters to "Engineering and Mining Journal")

London, Sept. 20—A cable received today from Melbourne, Australia, states that the Broken Hill Proprietary Co. has decided to resume production of zinc concentrates.

Czechoslovakia Gold Mines To Be Reopened

(Cable by Reuters to "Engineering and Mining Journal")

Paris, Sept. 20—A French financial group is preparing to resume operations at the disused gold mines near Eule, in Czechoslovakia. Modern machinery will be installed.

Production of Minerals Decreases in Japan

(By Reuters Agency)

Tokyo—It is reported by the Department of Agriculture and Commerce that during June, 1921, nearly all kinds of minerals decreased in production from the preceding month, as may be seen from the following details:

	June	May
Gold, *momme*	160,640	155,164
Silver, *momme*	2,703,125	3,197,362
Copper, *kin*	7,618,347	8,992,894
Iron, *French tons*	3,089	4,868
Coal, *French tons*	1,844,299	2,226,575
Kerosene oil, *koku*	157,002	148,256
Sulphur, *French tons*	2,712	3,732

The total for the first six months of 1921:

	January-June, 1921	January June, 1920
Gold, *momme*	943,267	978,705
Silver, *momme*	17,641,175	19,474,708
Copper, *kin*	45,500,976	54,973,541
Iron, *French tons*	18,376	34,129
Coal, *French tons*	11,928,890	13,353,554
Kerosene oil, *koku*	946,543	933,222
Sulphur, *French tons*	12,983	22,111

A *momme* = 0.1325 oz.; a *kin* = 1.325 lb.; a *koku* = 47.6 gal.

Topographic Mapping Program To Be Pushed

Every effort will be made at the regular session of Congress, which begins in December, to convince the Appropriations committees that the topographic mapping program outlined by the Board of Surveys and Maps should be carried forward. This program calls for $950,000 during the fiscal year of 1922-23.

Purchases of silver by the Bureau of the Mint during the week ended Sept. 17 were 1,462,000 fine ounces, bringing the total purchases under the Pittman Act to 72,850,430 fine ounces.

Gold Hunter Co. Wins Decision In Rio Grande Rate Case

Interstate Commerce Commission Holds Freight Charges on Ore Unreasonable—Should Be Based on Net Value of Shipment

The recent decision of the Interstate Commerce Commission in the case of the Gold Hunter Mining & Smelting Co. has been of much interest to Colorado mining men. This company complained that freight rates assessed on the gross value of ore or concentrates shipped from the Cœur d'Alene district of Idaho to Salida, Col., were unreasonable and unduly prejudiced, and in the decision of the Interstate Commerce Commission the contention was sustained.

It has been the custom of the Denver & Rio Grande R.R. to establish rates on ore and concentrates based upon the gross assay value of the ore, allowing no deductions for refining or handling at the smelter. Colorado and Utah mining men have contended that rates based upon gross assay values were inequitable and often misleading, as with complex ores or concentrates, the values shown by the assay certificate are often not recovered by the smelter. On the contrary, in the case of ores or concentrates carrying zinc, the ores are penalized to greater or less extent.

The decision not only involved a matter of freight rates on ores from Idaho, and a readjustment of local rates, but has direct bearing upon the smelter situation in Colorado, as it is necessary to ship in large quantities of lead ores to be used as a flux in smelting the ores from Colorado properties.

In referring to gross and net value rates, the Interstate Commerce Commission says:

"While defendants contend that under the net-value method smelter returns can be manipulated to secure lower rates, it appears that there are means of detecting such manipulation and that the gross-value method is not free from the same possibility of abuse. Indeed, the interpretation of gross value which defendants now urge does not correspond with the interpretation which has frequently been applied in practice, for the evidence shows that in many cases the metal contents have not been taken at 100 per cent but at some lesser percentage determined by the amount that can be extracted from the ore for commercial purposes. Upon argument, also, counsel for defendants was apparently uncertain whether all of the metals are or should be included in the reckoning, or only those which are commercially utilized. The presence of zinc, for example, in the ores in question detracts from rather than adds to actual value. The voluntary and general application of the net-value rates by ore-carrying roads other than the Rio Grande is in itself strong evidence both of the practicability and of the reasonableness of the net-value plan. It is clear that this 'net value' approximates the actual value of the ore far more closely than does 'gross value.'"

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Unemployment Situation Worst In Lake Superior District

Conditions Vary Widely, According to Reports Received by Government—Butte Suffers Most in West

That unemployment in the metal-mining industry varies widely in different districts is shown by figures being gathered by Government agencies for use at the unemployment conference called by Secretary Hoover. It is estimated that the industry is employing fully 50 per cent less men than in 1913. The reports indicate, however, that many of the men have found employment in other industries, and, except in the important copper districts, it seems unlikely that there will be distress among metal-mine workers this winter.

The activity in gold and silver mining absorbed many workmen last summer. From California it is reported that no miners are looking for work in that state. The unemployment problem in the metal-mining industry, as well as in the coal-mining industry, is in fact an eastern one, that is, east of a line drawn north and south through the eastern boundary of Kansas. It is a fact not generally recognized that the large majority of metal-mine workers are employed east of that line.

The hasty surveys which have been made indicate that the worst condition is in the Lake Superior region. The prospects there are brightening, however, owing to the probability of increased employment on the iron ranges. The better prospect for the iron and steel industry has led to a recent improvement in employment in the iron mines in Alabama.

One of the effects of the Pittman Act is that it makes possible the operation of lead-silver properties, which furnish work to many men in several states. In the zinc-mining districts the seriousness of the unemployment situation is relieved by the fact that agriculture and highway construction have offered ready employment to most of the men who have been relieved of work in the mines.

The most serious situation with regard to unemployment in the West is in the Butte district. Unless there is an increase in operations there before winter, it is believed that there will be want and suffering. Part-time operation has been in effect throughout the summer, so as to make possible the employment of the maximum number of men. Preference has been given to employees with dependents.

Though 30 per cent fewer men are being employed in the mines of Idaho, many of those who have been relieved have found employment as prospectors. In the Coeur d'Alenes district, the price of silver is keeping things going. In southern Idaho, there is no noticeable unemployment. The same is true of Wyoming. In the Black Hills, as well as in the other gold-mining regions, employment is above normal. Taking Utah as a whole, the employment situation is regarded as practically normal, as the mining of other metals has absorbed the men thrown out of employment by the closing of copper mines.

With the completion of the harvest season and the suspension of highway work on account of weather conditions, it is anticipated that there will be marked increase in general unemployment and that the number classing themselves as metal-mining operatives will show a considerable increase.

Rhodes Studying Mining Industry

The fact that Representative Marion E. Rhodes, the chairman of the House Committee on Mines and Mining, is accompanying Director Bain of the U. S. Bureau of Mines on a considerable portion of his extended Western trip is pointed to as being unusual in that it is the first time that a chairman charged with mining legislation has shown such determination to acquire first-hand knowledge of the industry.

Copper, Lead and Zinc Figures Wanted More Often

Publication by the U. S. Geological Survey of weekly figures of coal production and monthly figures of petroleum production is leading to increased demand for more frequent publication of copper, lead and zinc figures. Before this can be done, however, it will be necessary for Congress to authorize increased appropriations for the mineral resources work of the Survey.

NEWS BY MINING DISTRICTS

London Letter

Rumored Rand Companies Seek To Sell Production in Advance—Bwana M'Kubwa To Use M. S. Flotation Process — Lonely Reef Reserves Decreasing

BY W. A. DOMAN

London, Sept. 6—According to a rumor cabled from Johannesburg, the Transvaal gold-mining companies are endeavoring to make an arrangement for selling their product forward. Many would doubtless like to be able to do this, but so far as I can gather from responsible quarters, there does not seem much chance of the change being made.

The exchange position is too uncertain for any government or firm to enter into a prolonged contract. If such an arrangement were practicable, the Shamva Mines (Rhodesia), for one, might benefit very considerably. In 1915, the cost to this company of mining an ounce of gold was £2 6s. 5d.; the average for 1920 was £3 5s. 9d., though in the final quarter the figure was £3 6s. 2d. For the first three months of the current year, owing to the strike of white employees, it was £4 3s. 0d., and for the second quarter £3 12s. 7d. At the standard rate per ounce this does not leave much margin for capital expenditure and dividends.

As with other companies the Shamva Mines is now largely dependent upon the gold premium. In the December quarter of last year 147,300 tons of ore was crushed, and in the three months to June 30 of this year the quantity had risen to 164,150 tons. In January the reduction plant was augmented by eight Nissen stamps, and these are running satisfactorily. Their installation has afforded an opportunity of repairing sections of the old stamp mill.

Cost of development is quite reasonable at this mine, for the charge to working expenses is only 9d. per ton. Hopes were entertained of a fall in the cost of supplies, but such benefit has not yet materialized, as cyanide and explosives have actually gone up in price.

The ore reserves fluctuate with the price of gold—in this way: that when the premium is high it is possible to draw upon low grade that otherwise could not be treated at a profit. At Dec. 31, 1920, the reserves were estimated at 1,981,250 tons, and at June 30 last at 1,831,000 tons; allowing, there-

fore, for the quantity crushed, new ore to the extent of 106,250 tons has been added. The average value of the whole remains at 4.1 dwt.

The reorganization of the capital of the Bwana M'Kubwa is being discussed again. At the end of last year estimates were in hand for developing and equipping the mine for a plant of 1,000 tons a day capacity, and paying off a debt of £26,000, the total amount involved being £300,000. For years the property has lain dormant, owing to the character of the ore. The Minerals Separation has, however, devised a process for extracting the copper. It has been officially stated that there is at least 3,000,000 tons of ore proved assaying from 4 to 5 per cent, with the probability of many more millions of tons to be developed.

Though the Lonely Reef continues to open up ore of high gold content in the lowest levels, the 23d and 24th, the average of the reserves is gradually lessening. This can be seen from the estimates at the following dates:

Dec., 1920	March, 1921	June, 1921
Tons	Tons	Tons
202,845	200,555	197,704
Dwt.	Dwt.	Dwt.
20.80	19.98	19.11

Actually the tonnage has not suffered any great reduction, and a fall in value of 1.69 dwt. over the whole reserves in six months is not so serious at this mine as it would be at many other properties.

At the date of the June quarterly report the 23d and 24th levels were disclosing good values, though rather more variable than in the levels above. The new gas plant is being erected, and the part that has been put into operation is giving satisfaction. By the end of October the installation should be complete, and it is expected that working costs will be reduced in consequence by £2,000 monthly.

Johannesburg Letter

Strike of Mine Workers Averted—South African Statistics

BY JOHN WATSON

Johannesburg, Aug 9.—There is general satisfaction at the news that, as a result of a series of conferences between the Chamber of Mines and representatives of the various unions, there is to be no strike. A reduction of 1s. 6d. per shift has come into force from Aug. 1, and the Chamber has agreed that this shall be the only reduction up to the end of this year. *The Star* of Aug. 6 says: "The consolidation of the 3s. 6d. per day on the wages almost meets the demand of the joint executives for a 4s. per day consolidated increase, and certainly goes much further than many people anticipated the mines would be prepared to go."

The Chemical, Metallurgical and Mining Society is locally designated by the formula CM_2S for the sake of brevity. At its twenty-fifth annual general meeting the election of officers and council took place as follows: President, F. Wartenweiler; vice-presidents, Prof. G. A. Watermeyer, F. W. Watson, and C. J. Gray; treasurer, William J. R. Thurlowe. The twelve members of the new council include four past presidents, whose long experience it is hoped will strengthen the society. The new president is on the consulting metallurgical staff of "The Corner House" (that is, the Rand Mines and the Central Mining & Investment Corporation group) and had formerly a wide experience in American metallurgical practice with C. W. Merrill, and others.

The quarterly abstract from the office of census and statistics for the Union was recently issued (price 1s.). The latest census (May, 1921,) shows a white population of 1,523,424. The length of government railways open in 1920 was 9,542 miles. The Union production for 1920 was 8,158,455 oz. fine gold; 2,545,017 carats diamonds, and 11,473,452 short tons of coal. The total mineral production for 1920 had a value of £55,193,389, and the factory output for the year (July, 1919, to June, 1920) had a gross value of £92,913,844.

AUSTRALIA

Price of Osmiridium Declines in Tasmania

Hobart, Sept. 14—The price of osmiridium has dropped to £18 per oz. Many miners are giving up the quest for the mineral.

Melbourne—Alluvial tin was discovered early in the summer on King Island, in Bass Straits, and, the assay proving good, sluicing has been started.

CHOSEN

Unsankinko — The August clean-up of the Oriental Consolidated Mining Co. was $75,500.

MEXICO

Federal District

Government Holds to Its Position of Refusing Special Aid to Mining Industry

City of Mexico—While new denouncements are being made in various parts of the republic, and many owners of old properties are paying back taxes, the general mining situation remains far from satisfactory. Owing to the depressed price of lead, the big, low-grade silver properties in the northern part of the country are not paying and cannot pay under existing conditions, and the great silver properties in the central plateau regions with high-grade ores cannot meet the excessive costs of labor and materials and what they term the exaggerated export taxes which the government insists on maintaining.

This is the mining man's side of the case. The facts are, however, that most of the important silver properties continue operation, with the exception of two or three concerns in the State of Michoacan, and their closing appears to be due more to certain local conditions than to anything else. It may also be remarked that despite the pessimistic tone of the average mine owner, new properties are being taken over by some of the most important groups now operating (at an alleged loss), and they seem to be in nowise dismayed regarding the final outcome of Mexico's most important industry.

The Minister of Finance announces that it is not the intention of the government at present or in the near future to change the present taxation on the import of mining supplies nor the export duty. The government insists on the point that the metal industry must work out its own salvation, and expresses the belief that conditions are slowly but surely returning to normal. For many months official protection was given the mine owners in the way of exemption from export taxes and special concessions regarding bringing into the country all sorts of supplies used in mining operations. It is contended by the authorities that the lift should have enabled the mining men to readjust themselves to meet present conditions; that a continuance of federal support would more incline them to lean on the government and not endeavor to work out the problem on their own account. Hence the pulling away of the props.

The minister also denies the report that there is any immediate intention of prohibiting the exportation or importation of silver into the country. There is nothing alarming in the present situation that calls for drastic action. Though the local banks are refusing to accept silver deposits, except in a separate category, the condition is purely local; that is to say, the surplus of silver money is confined largely to the Federal District, there being a shortage in the interior. It is believed that the opening of the new Bank of the Republic this month, with probably an initial paid-up capital of 30,000,000 or 40,000,000 pesos, will regulate the monetary situation, and will naturally affect the mining industry for the better.

Jalisco

James Gerard Visits Cinco Minas Property

Guadalajara—James Gerard, former American Ambassador to Germany, recently arrived here en route to the Cinco Minas property near Magdalena, accompanied by several persons interested in the property. Mr. Gerard is president of the Cinco company and, with the Daly interests, controls practically all the stock.

It is reported that the principal object of Mr. Gerard's visit is to pass upon the desirability of taking over some nearby properties which the Cinco Minas is said to be badly in need of in view of the fact that its own ore is running low.

Cinco Minas, which is a large body of low-grade silver, has returned big profits in times past. Owing to the character of the ores and the fact that

the section has suffered less by labor agitation than many sections of the country, the company continued dividends when many properties were obliged to close down owing to the heavy decline that occurred in the price of silver.

Baja California

Construction of Boleo's Converter Plant Under Way

Santa Rosalia—Cie. du Boleo is installing a converter plant, but no date has been set for its operation. The company is producing 100 tons of copper per month, as compared with a normal output of 1,000 tons. Since June, 1916, all matte and black copper has been shipped to the Tacoma smelter. The matte formerly ran 62 to 63 per cent copper, but in recent years pyritic ore from Shasta County, Cal., carrying about 2 per cent copper, has been used for flux. The present grade of the matte is about 50 per cent copper. This matte is put into the reverberatory at Tacoma, where it melts and combines with the other matte produced in the furnace. The black copper running 92 to 93 per cent copper is charged into the converters.

Chihuahua

Silver Exports From Chihuahua to the United States Increasing Compared With Former Years

Chihuahua—Consul James B. Stewart, at Chihuahua, Mexico, under date of July 29, 1921, reports that more silver was produced in the Chihuahua consular district (which includes such important silver camps as Parral, Santa Bárbara, Santa Eulalia, and Cusihuiriáchic) during 1920 than any year since 1910. In fact, judging from the available figures, 1920 was one of Chihuahua's banner years, comparing favorably with the best years previous to 1910 and no doubt exceeding most of them in the total amount of silver produced.

The increased silver production in Chihuahua is not due to the operating of a larger number of mines (fewer are being operated than in former years), but to the ability of large mining companies, mostly American, to work the large low-grade properties, this having been made possible by the installation of modern machinery and new processes of ore handling and treatment. Especially has this been the case in the Parral district, which is one of the world's leading low-grade silver camps. The following table shows the bullion and ore declared at the Chihuahua Consulate for export to the United States during 1920 and the first six months of 1921:

	Calendar Year 1920		First Six Months, 1921	
	Troy Ounces	Value	Troy Ounces	Value
Bullion:				
Gold-silver-lead	4,968,570	$4,888,354	3,121,189	$1,866,365
Silver	3,717,747	2,411,250	1,870,786	1,111,304
Raw matte	287,472	241,797	29,854	17,533
Silver ore	187,615	231,621	.....	.....
Totals	9,161,404	$7,773,022	5,021,829	$2,995,202

As the entire silver production of this district is exported to the United States, the preceding table gives a fair idea of the silver produced in the district. These figures, however, must not be taken as showing that the Chihuahua mines are now producing more silver than last year, because for several months the lead smelter at Chihuahua, which produces the gold-silver-lead bullion, has been the only large one of its kind operating in Mexico, and so it has been receiving and smelting rich silver ores and concentrates from various parts of the Republic, even from mines in the vicinity of Mexico City. Whereas the ores usually smelted at Chihuahua average around 6 kg. of silver per ton, the high-grade ores being received from the south average as much as 12 and 13 kg. and even more.

The mining industry is also improving in some districts. The freight congestion which existed at Ciudad Juarez was cleared in June, and it was stated that freight shipments from Ciudad Juarez to Chihuahua take only one day longer than express shipments.

CANADA

British Columbia

George Wingfield Sues Taylor Engineering Co.—Granby's Smelter Remains in Blast

Stewart—The Fish Creek Mining Co. has made a trial shipment of twenty tons of ore, valued at from $500 to $600 a ton. The first shipment of concentrates from the Premier mine, Salmon River, was made a few weeks ago. It consisted of 160 tons, estimated as being worth about $1,750 a ton.

The Silverado property has been acquired by a syndicate headed by J. J. Coughlan, of Vancouver. It is on the west side of Portland Canal opposite the mouth of Bear River and the town of Stewart. The new owners intend building a light tramway from the discovery at 4,200 ft. elevation down to the 2,200 level. From this point a trail will be built to tidewater. The plans also include the construction of a permanent camp.

Alice Arm—The North Star has shipped ninety tons of ore to the smelter at Anyox.

Action has been brought against the Taylor Engineering Co. in the Supreme Court of British Columbia by George Wingfield, of Reno, Nev., for the recovery of $182,322. This money it is alleged is owing to Mr. Wingfield and his associates by the company on account of liabilities undertaken when the Dolly Varden mine came into the possession of the company. It will be recalled that the Provincial Legislature laid down certain terms to which the Taylor Engineering Co. subscribed itself. One of these was the payment of $150,000, which it now is claimed has never been paid. The difference between that amount and the amount sought through the courts is accrued interest.

Considerable note is taken locally in recent developments on the Toric group of mineral claims, on Kitsault River. A promising body of ore is said to have been opened up. The Toric is situated on the Dolly Varden railroad grade and not far from that mine.

Anyox—The question was recently put before the workmen of the Granby Consolidated Mining, Smelting & Power Co. as to whether the Anyox plant should close down or wages be reduced. A vote was taken on the issue by the men, the result being a very substantial majority in favor of the continuance of work.

Nelson—Supplies have been sent up to the Bayonne property, on the north fork of Summit Creek, recently acquired for Spokane interests. It is planned to work it during the winter.

Rossland—Operators of the Velvet mine, south of Rossland, have made tentative plans for production and shipment of ore during the winter.

Kaslo—O. C. Thompson, lessee of the Utica mine, is repairing the wagon road from Adamant station to the property and preparing for operations.

Vancouver—Sperry & White, of Vancouver have secured control of the Eureka silver mine, in the Cheam Mountain near Hope, and are said to be planning to spend a considerable sum on development and plant. The Eureka is one of the oldest mines in the province.

Ashcroft—The Highland Valley Mining Co., owning a copper prospect about forty miles from this point, has been reorganized on an assessable basis. The first assessment of 1c. per share has been levied.

Trout Lake—What is believed to be Iceland spar has been found in this vicinity. Samples have been sent to Ottawa for determination.

Trail—Ore received by the Consolidated M. & S. Co.'s smelter during the week ended Sept. 7 was as follows:

Name of Mine	Locality	Wet Tons
Company Mines	.....	6,287
Josie	Rossland	89
Knob Hill	Republic	77
Little Mamie	Ainsworth	11
Paradise	L. Windemere	45
Spokane Trinket	Ainsworth	43
Total	.....	6,552

Ontario

Foster to Take Up Option on Murphy Claim in Goudreau District

Porcupine—The Nipissing has taken an option on the Edwards and Rochester properties and will drill them both.

It is expected that with a few minor changes the capacity of the Hollinger mill can be brought up to 4,000 tons a day. During one day recently 3,789

tons was milled. The company has declared the regular four-weekly dividend of 1 per cent, payable Oct. 7, making total disbursements so far this year of $2,460,000.

The amalgamation of the West Dome and Dome Lake is proceeding satisfactorily. It is understood that the new company will have a capital of $5,000,000, and that the treasury will be financed to the extent of about $200,000.

Up to the end of June, 1921, the MacIntyre mill had treated 1,152,150 tons of ore, having an average value of $9.58 per ton, and recovered $11,035,564. Dividends amounting to 70 per cent have been paid.

The McEnaney Gold Mines, Ltd., is the name of a new company, with a capitalization of 3,000,000 shares of $1 par, which has taken over the old Hollinger Reserve property.

Cobalt—During August the Nipissing mined ore of an estimated net value of $172,931, and shipped bullion from Nipissing and custom ores of an estimated net value of $236,558. Silver was taken at 63c. an oz. On the 2d level of the No. 63 shaft a new vein has been found which has a width of 2 to 3 in. and assays several thousand ounces to the ton. The low-grade mill treated 7,325 tons, and the refinery shipped 381,504 fine ounces of bullion.

At the annual meeting of the Oxford-Cobalt Silver Mines, Ltd., the two Waldman claims adjoining the Oxford were taken over for a consideration of 150,000 shares of stock. The report states that during the year encouraging silver values were found. The financial statement shows $500 cash on hand, and buildings and equipment valued at $10,900.

Seventy-five feet of drifting has been done on the new discovery on the Violet property of the La Rose, and the values are stated to be satisfactory.

It is understood that the option held by C. A. Foster and associates on the Murphy property, in the Goudreau gold district, will be exercised. This property was discovered a few months ago, and showed some spectacular values. The price is stated to be about $350,000, but it is understood that a large part of this will be paid with stock.

WASHINGTON

Senator Poindexter Visits Magnesite Properties

Chewelah—Senator Miles Poindexter paid a visit to the quarries and plant of the Northwest Magnesite Co. early in September for the purpose of gathering first-hand information regarding magnesite, for which local producers wish to obtain tariff protection.

What may be an important strike on the Old Dominion mine was made on Sept. 10, when a short crosscut from the lower tunnel encountered a 3-ft. body of high-grade ore.

Tacoma—The Tacoma smelter and refinery is running at about half capacity. The three blast furnaces are cold, but the reverberatory is running to capacity. A 30,000-cu.ft. Ratteau-Battu-Smoot turbo compressor has been installed. It runs at 3,600 r.p.m., and furnishes converter blast up to 15 lb. per sq.in. The compressor is driven by a direct-connected 2,000-hp. Ridgeway motor.

The Danish motor ship "Siam" recently discharged blister from Braden and custom copper ore from various Chilean mines.

Leavenworth—Under provisions of a deal made recently, John Smith, a miner and prospector of this section, has disposed of a group of five claims held by him for a number of years to the Royal Development Co., receiving a substantial cash payment and monthly payments during his lifetime, together with the right to mine on the ground himself with two helpers. The ore is principally copper, with some high-grade silver and gold.

Northport—A. J. Hodges and A. F. Gentsch have leased a section of the Silver Bee mine.

Everett—It is currently reported that the Boston-American Mining Co. plans to do work on properties acquired the last few years in the Monte Cristo district.

Orient—The First Thought Mining Co. is planning to instal a cyanide mill.

OREGON

Gold Properties in Southwestern Part of State Being Reopened

Grant's Pass—Henry M. Lancaster, of the St. Lawrence Copper Mining Co., of Saltese, Mont., has an option on a large tract of mineral land sixteen miles from Grant's Pass. The vein on the tract contains platinum, iridium, and gold.

Jacksonville — The Bell-Mankin gold mine, an old producer three miles out of Jacksonville, consisting of eighty acres of mineral land, is being reopened by Clark & Childers, of Medford, Ore., under a lease.

Selma—The Myrtle gold mine, near Selma, owned by Frank Hobart and B. W. Fowler, two local operators, is being reopened.

Jacksonville — The Opp mine, two miles west of Jacksonville, has just been reopened. This property, which is credited with an excellent production, has been closed since 1914. There is 7,000 ft. of underground workings. The surface equipment consists of a six-drill compressor, a 20-stamp mill and a 125-ton cyanide plant. The California-Oregon Power Co. has announced that its power line will be extended beyond the Opp mine west toward the Gold Ridge, Millionaire, Centennial, and Roaring Gimlet mines, now in operation in the Gold Hill district.

Baker—Following careful prospecting of the I. X. L. group this season on behalf of prospective purchasers, a deal has been made for disposal of the property by the Hidden Treasure Gold Mining Co., which has held the ground for a number of years. The property is east of Greenhorn, in Grant County.

MONTANA

Anaconda Rebuilding Badger State Hoisting Plant—Rumors of East Butte-Davis Daly Consolidation Denied

Butte—The Anaconda Copper Mining Co. is rebuilding its hoisting plant at the Badger-State mine, one of its larger properties in the Butte district, installing new drums calculated to increase the capacity of the engine up to 4,000 ft. The present depth of the Badger-State is 2,800 ft. New skips will be installed, and the property will be placed in condition to afford an increased output. Anaconda also is taking the present occasion to concrete the Mollie Gibson shaft, an airway located just to the north of the St. Lawrence shaft. This concreting is a fireproofing measure. The Anaconda has been doing more or less repair work, such as fixing ore chutes at the West Colusa. The Colusa ores carry a fair amount of silver.

Butte & Superior expects to have more definite information about the recently opened body of copper ore on the 2,200 level within the next ten days, according to the local management. The average assay across 18 ft. was given at 2.6 per cent copper. Parts of the face ran as high as 7.6 per cent copper.

The Tuolumne Copper Mining Co. is continuing to drift westerly on the 1,600 level of the Spread Delight, with a somewhat higher grade of ore appearing and with the ground getting softer with more water in evidence.

The East Butte Mining Co. is the center of much interest locally in consequence of reports, which lack confirmation, of a pending merger with the Davis-Daly, or of some kind of negotiations said to be under way looking to a closer relationship between the two companies. Local officials of both concerns profess positive lack of knowledge respecting the rumors. The advantages which would accrue to the Davis-Daly through an ownership of East Butte's smelting plant are obvious, according to some, and the fact equally appears obvious to the same people in that the greater part of the East Butte's present good showing is traceable to revenue had from the treatment of the Davis-Daly's ore.

The Elm Orlu Mining Co. has opened the Rainbow vein on the 2,500 level, and according to unofficial advices the showing of zinc is somewhat of a disappointment. The silver content has held its own and the lead increased. It is considered possible, however, that the heart of the orebody as shown on the upper levels is raking to the east.

Elkhorn—Stringing of a large copper cable to permit of increased power delivery to the Elkhorn concentrator of the Boston & Montana has been started from the Butte substation of the Montana Power Co. to the latter's Big Hole River station. The construction of the line from the station to Elkhorn is rapidly nearing completion.

NEVADA

Construction Work at Gold Hill Progressing Rapidly—Development of Orleans Mine Favorable

Virginia City—Actual concrete construction on the fine-ore bins of the new plant of the United Comstock Mines Co. at Gold Hill was started Sept. 9. Excavation for the foundations of the coarse-crushing plant is practically completed. Lodging, mess, and general office buildings will be completed about the end of September. Work has been started on residence cottages.

The main haulage tunnel, which is now 75 per cent completed, is 2,400 ft. from the portal, and will make connection to the Knickerbocker shaft about Oct. 1.

Tonopah—Recent bullion shipments from this district, representing clean-up of operations for the last half of August, are as follows: Tonopah Belmont, $94,330; Tonopah Mining, $55,000; West End, $70,000, and Tonopah Extension, $50,000. In the Tonopah Extension much development work is being done. At the Belmont 500 tons of ore per day is being mined. The auxiliary mill, for the treatment of sweepings from the tailing ponds, was started on Sept. 8, treating thirty-five tons per day.

At the Tonopah Mining Co. ore is being hoisted from the Mizpah, Sandgrass, and Silver Top shafts. Tonnage mined for the week ending Sept. 5 was 1,650.

The West End is producing 225 tons per day from the West End and Ohio shaft. At the Halifax a station is being cut at the 900 level, and as soon as it is completed a crosscut will be driven to cut the orebody discovered several months ago in a raise from the 1,000 level.

Divide—The Tonopah Divide mine is shipping fifty tons of ore per day to the Belmont mill at Tonopah. The ore averages better than $30 per ton. The shaft is making fair progress and is now about 25 ft. below the 1,000 level. Lateral development is being carried on from the 100, 200, and 800 levels.

The Divide Extension is making regular thirty-ton shipments to the MacNamara mill at Tonopah. The ore is high grade. The faulted segment of the vein is reported to have been cut in the 200-level crosscut, with low values so far.

The Giant Divide is running two development faces on the 450 level. The Brougher Divide is drifting on the 185 and 500 levels. The drift on the 185 level, which is following the extension of the Divide Extension vein, shows occasional spots of high grade.

Hornsilver—Reports on the development in the Orleans mine are favorable. It is claimed that the foot-wall drift driven by Dunfee, former lessee, was parallel to the ore shoot, and that by simply driving short hanging-wall crosscuts the shoot has been proved to have a total length of 300 ft. on the 600 level. The vein is over 20 ft. wide in places, with high-grade streaks in evidence. The average grade is not shipping ore, but will pay to mill. A 50-ft. winze from the 600 level is in ore, and the main shaft is to be sunk an additional 200 ft.

Pioche—The Mendha mine, in the Highland district, about eight miles from Pioche, has been leased to Roy V. Bicknell, who has a car of lead-silver ore ready to ship.

Judge Frank Walker and Henry Olinghouse, of Pioche, have taken a lease on the Point mine, owned by the Pioche Metals Mining Co., and have started a development tunnel to open up a body of silver-lead ore exposed on the surface, by recent severe rains, at a point 200 ft. south of the main shaft.

Ely—The holdings of the Eureka Hamilton Mining Co. have recently been sampled by W. H. Washburn, of the Tonopah Mining Co.

The recent discoveries of gold ore at McCoy Creek, in Spring Valley, are still being developed by the Millick brothers, with good results on the main property. Little interest is being taken in adjoining property.

Steady progress is being made in the work of tuning up the milling plant of the Wyoming Mining & Milling Co., at Taylor, and the plant should be running soon. Ten men are employed.

The big copper companies are doing nothing toward resumption of work, and Ely is very quiet.

CALIFORNIA

To Build 100-Ton Mill at Kelly Mine—Belmont Shawmut Mining Co. Resumes Work

Jackson—Prospects for early resumption of ore production on a larger scale at the Kennedy continue bright. The Argonaut is operating steadily, and development and prospecting of new areas in the mine is being planned.

Shawmut—The Belmont Shawmut Mining Co. has resumed production. Since the shutdown in August, 1920, the shaft has been completely retimbered and the mine maintained in good condition. The mine will be developed at greater depth. A surface plant in good condition is ready to be used. The capacity of the mill and cyanide plant for treatment of concentrates is 400 tons per day. O. McCraney is superintendent, B. E. Rowe mine superintendent and Carl Wark mill superintendent. Frederick Bradshaw is general manager.

Sutter Creek—At the Central Eureka a contract for sinking the main shaft 200 ft. deeper has been made. During August, 3,136 tons of ore was milled, and production reached $42,000. A. S. Howe is superintendent.

Georgetown—At the Grit mine, near Spanish Dry Diggings, a rich strike is reported by Walter King.

Randsburg—The California Rand Mining, Ltd., better known as the Kelly mine, has decided to install a 100-ton mill, and machinery has been ordered. The mill, as planned, consists of a coarse-ore bin receiving ore from the shaft, a Blake rock crusher, an elevator to a 200-ton wooden bin, a ball mill, a classifier and thence to a tube mill, where a final product of minus 80 mesh will be made. This product is to be treated in M. S. flotation machines. A table is to be used as pilot before the flotation machine, and the tailings from the flotation unit will be passed to another table before going to waste. The concentrates are to be settled in canvas-bottom drying tanks. The question of treating the concentrates at the mill is under discussion. It is expected to have the mill in operation by the first of the new year.

Thirty stamps are in operation at the Yellow Aster.

The Randsburg Silver Mining Co. has struck a vein in sinking its shaft. The vein is parallel to the Kelly vein. A second parallel vein has been struck 200 east of the shaft in a crosscut. Drifts are being extended on this vein in both directions.

Grass Valley—The North Star is operating sixty stamps, and the labor output has reached the figures obtained in 1913.

COLORADO

Much Activity in Alma District—Rumored Deep Operations at Cripple Creek Financed in East

Alma—The slump in the mining of gold and silver in the Alma district has apparently passed the critical stage, as indicated by the resumption of operations by a number of the larger companies. Several new projects have been organized, and the preliminary development work has been started.

The Yuba Construction Co. has started work on the first of a fleet of four gold dredges to be installed on the middle fork of the South Platte River, near Fairplay. A complete survey by several churn drills, covering a period of three years, has established the fact that this deposit of pay gravel is the largest known in the United States, and it is stated that sufficient pay gravel is now developed to keep this fleet busy for fifteen years.

The Colorado Power Co. has a force of men installing a new power line from the company's terminal, one mile north of Alma, to the Yuba dredge. This extension will be about eight miles long.

W. K. Jewett, A. H. Hunt, and J. L. Bennett, of Colorado Springs, have incorporated the London Gold Mines Co., capitalized at $100,000, the stock being divided into 10,000 shares with a par value of $10 each. The company has started a drive of 2,500 ft. in the lower London tunnel. This tunnel when complete will be over 4,000 ft. long and will open the London vein 600 ft. below the present workings.

The London vein has been very strong and continuous and has been worked for approximately 3,000 ft. in length

and to a depth of about 700 ft. from the surface, producing about $6,000,000.

The ore occurs in the white porphyry, and on the contact of the white and gray porphyry. These porphyries constitute the filling of the London fault, which at London Mountain shows a vertical displacement of about 1,500 ft. The ore is a white quartz containing gold, silver, lead and copper, the gold value predominating and showing from 2 to 10 oz. per ton.

Albert Johnson & Co., lessees on a block of ground in the South London workings, shipped to the A. V. smelter at Leadville 100 tons of 7-oz. gold ore the latter part of August, and have a second similar shipment ready.

The Louisiana & Colorado Mining Co. resumed operations Sept. 1, and is extracting a good grade of silver-lead ore from the Dolly Varden property, situated on Mount Bross. The ore is transported over the company's two-mile tramway to its flotation mill on the Platte River, one and one-half miles north of Alma. Electric power for the mine, mill, and tramway is secured from the lines of the Colorado Power Co.

The Russia Consolidation Mining Co., on Mount Lincoln, has a force of men busy excavating for the foundations of an electrically driven compressor, and surveys are being made to connect the mine with the lines of the Colorado Power Co. at Quartzville, one and one-half miles away.

A Denver company has taken a lease on the Champaign mine, in North Mosquito Gulch, and is building a road preparatory to installing a gasoline-driven air compressor. A large amount of development will be done. This property has produced high-grade gold and silver ore.

The Pulaski Investment M. & P. Co. has opened up a large body of milling ore on the Brownlow property in Mosquito Gulch, and has started to erect a fifty-ton concentrator.

A large body of lead-silver ore has been developed in the Hill Top mine, in the Horseshoe district. Regular shipments of five cars a week are now being made to the A. V. smelter at Leadville.

G. W. Logan is making regular shipments of a good grade of gold-silver-lead ore from the Hocking property, on the southeast end of Pennsylvania Mountain.

The Milan Placer Co., operating in Buckskin Gulch, two miles west of Alma, has finished installing its flumes and pipe line and is ready for a campaign the coming season.

The Calumet & Hecla Co., operating on Mount Lincoln, is working two shifts on development, endeavoring to get a lower tunnel into the known orebody before winter sets in.

In Buckskin Gulch, development work is being pushed on the Sweet Home, Criterion, Red Lion, and Silver Wave properties, all of which are adding their quota of gold, silver, lead, and copper to the production of the camp.

Cripple Creek—Bulkeley Wells has been elected a director of the Cresson Consolidated Gold M. & M. Co., and also of the Golden Cycle Mining & Reduction Co., both Cripple Creek properties controlled by the Carlton interests.

The association of Bulkeley Wells with the most active mining enterprises in the camp is connected with the report that a strong group of eastern capitalists have undertaken to finance deep mining operations in the Cripple Creek district.

Governor Shoup, with Ralph D. Brooks, vice-president of the Midwest Refining Co., and other mining men of Denver, have incorporated the Ajax Mines Leasing Co., and have taken a five year lease on the Ajax property. This consists of about 28 acres adjoining the Portland property on Battle Mountain.

Production in the district for August was 39,500 tons, with a bullion value of $411,792. As compared with the previous month, there was an increase in production of $117,211.

A recent strike on the property of the United Gold Mines Co. promises to rank as one of the most important in years. Grab samples of the ore from a 7-ft. vein assay from $20 to $100 per ton, and a high-grade streak yields several hundred dollars, it is reported, to the ton.

Aspen—The Park Tunnel Transportation Co., a subsidiary of the Park Tunnel Co., has completed its survey for a tramway and secured terminal site on the railroad here. Both companies are financed by Leadville and Aspen capital, the tram company acting only as a transportation company to move ore from the Park tunnel. The tram will be of the aerial type, 7,500 ft. long, and is to be completed within ninety days. The company estimates that it has 200,000 tons of marketable ore blocked out at present.

Bonanza—The Eagle mine has been equipped with a mill, and is being developed and operated under the management of C. Erb Wuensch. Recent development work has opened promising additional ore shoots, and both crude ore and concentrates of payable grade are being produced.

Caribou — The Potosi-Caribou Mining Co., with a capital of $500,000, has been organized to operate the Potosi properties. The officers and directors are: J. A. F. Durocher-Stone, president; William Kline, vice-president; J. E. Riva, treasurer; R. J. Faulkingham, secretary; J. G. Clark, of Boulder, Col., general manager, and R. S. McKiernan. Machinery has been purchased and will be installed soon. Development work has been resumed.

Telluride—Shipments of concentrates during August were as follows: Smuggler-Union, 80 cars; Tomboy Gold Mines, 55; Liberty Bell, 5; total 140. This production compares with 95 cars for the same month last year. The Liberty Bell is now shut down permanently.

JOPLIN-MIAMI DISTRICT

Oklahoma-Kansas-Missouri

Underwriters' Land Co. To Resume Work at St. Louis, Okla.

St. Louis, Okla.—The Underwriters' Land Co. has decided to start up its No. 2 property at St. Louis, Okla., after a shutdown since some time in 1920. F. N. Bendelari, manager for the company, states that it is intended to seek particularly lead ore, and for this reason two shifts will be worked in the ground in the two lead drifts to supply enough ore to keep the mill busy for one shift. The company has kept the principal members of its working organization on its force during the shutdown.

MINNESOTA

Mesabi Range

Oliver's Screening Plant at Coleraine Tested

Coleraine—A test run of the new screening plant of the Oliver Iron Mining Co. has been made. This plant is to be operated in conjunction with the Trout Lake concentrator. All mixed material will go direct to it, and no sorting will be done in the pit.

CHRONOLOGY OF MINING

August, 1921

Aug. 1—Oliver Iron Mining Co. cut wages an additional 10 per cent.—Mexican government restored export and import taxes on mining products and supplies.

Aug. 5—Freight rate on pig lead reduced from $8 to $6 per ton between Pacific and Atlantic ports.

Aug. 6-7—Strike at Tonopah and Divide, Nev., declared off.

Aug. 8 — Stockholders of Erupcion Mining Co. voted to build fifty-mile railroad in northern Chihuahua.

Aug. 11—Reduction in freight rates on bullion between Western points and Atlantic seaboard became effective.

Aug. 12—Judge Bourquin decided in favor of limiting standard of comparison in Butte & Superior's accounting to Minerals Separation.

Aug. 15—Walter Fitch, Jr., Co. broke world's shaft-sinking record in Water Lily shaft of Chief Consolidated Mining Co., Eureka, Utah, by completing an advance of 427.5 ft. in 31 days.

Aug. 17—Suit of George C. Carson against Afterthought Copper Co. for infringement of a patent covering side feeding of reverberatories heard in San Francisco.—Reported from Australia that employees of Broken Hill Associated Smelters at Port Pirie had agreed to accept lower wages. — Announced from South Africa that miners on Rand would accept a wage cut. —Discovery of gold in Klondyke in 1896 celebrated at Dawson, Y. T.

Aug. 24 — Shareholders of Davidson Consolidated, Porcupine, Ont., ratified sale of assets to new company known as Porcupine Davidson Gold Mines.

THE MARKET REPORT

Daily Prices of Metals

Sept.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
15	11.875	25 875	26 375	4.60	4.40	4.175
16	11.875	25.625	26 00	4.60	4.40	4 175
17	11.875	25.625	26 00	4.60	4.40	4.175
19	11.875@12	26.00	26.25	4.60	4.40@4.45	4.175
20	11.875@12	26.125	26.50	4 60@4.65	4.40@4.45	4 175
21	11.875@12	26.25	26.625	4.65	4.45	4.175

*These prices correspond to the following quotations for copper, "delivered": 12.125c. for Sept. 15, 16, and 17, and 12.125@12.25c. for Sept. 19, 20, and 21.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
15	67 5/8	68 5/8	72 1/2	155	157 1/4	23 1/4	22 3/4	25	25 1/2
16	67 3/4	68 5/8	72 1/2	154 1/4	156 1/2	23 1/8	22 1/2	24 7/8	25 5/8
17	..	..	...	....	....	...	...	...	...
19	68 1/8	68 7/8	72 1/2	154 3/8	156 5/8	22 7/8	22 5/8	25	25 1/2
20	67 3/4	68 1/2	72 1/2	155 1/2	157 3/4	22 3/4	22 5/8	25	25 1/2
21	67 3/4	68 5/8	72	155 3/4	158	23	22 3/4	25 1/4	25 5/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver			Sept.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
15	369	99 1/4	64 5/8	39 3/8	19	371 1/2	99 1/4	65 1/2	39 3/4
16	370	99 1/4	65	39 1/2	20	370 3/4	99 1/4	65 5/8	39 7/8
17	371	99 1/4	65	39 1/2	21	371	99 1/4	65 7/8	40

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Sept. 21, 1921

The metal markets have generally been quiet during the last week, but prices have been firmly maintained. It is unlikely that any sudden price changes will take place in any of the metals, for conditions are gradually becoming more sound.

Freight rates to England have succumbed to competition, and are now $7 per long ton on zinc and copper, except on ingot bars, on which the rate is $8.

Copper

Both domestic and export demand has been exceedingly quiet during the last week, but prices have shown no tendency to ease off. Almost all of the producers are well above the prices which we quote, and it is generally thought that no copper can be obtained for less than 12.25c. delivered. However, careful buyers have been able to get the metal for prompt delivery at 12.125c. by shopping around, and a few sales of fairly large tonnages have been made at this figure. Yesterday there was an inquiry on the market for about a thousand tons, but it is reported that no one was willing to accept it for less than 12.25c., which was more than the buyer was willing to pay. The undertone is strong, and most producers are likely to continue to quote somewhat above what consumers care to offer. The market for forward delivery is nominal.

Japan, Germany, France, and England have all been in the market for American copper during the week, but sales have not been of large volume.

Lead

The American Smelting & Refining Co. increased its official contract price for lead from 4.60 to 4.65c. on Tuesday, Sept. 20.

Demand has quieted down somewhat, but the market continues firm at gradually advancing prices, owing to the depleted stocks of producers. Many have all of their September lead sold. The advance by the Smelting company yesterday was not unexpected, as outside traders and some other producers had been asking from 5 to 10 points premium over the 4.60c. figure. Up to the time the advance was made known small tonnages of both chemical and desilverized lead were obtainable in St. Louis at 4.40c., but despite this fact some lead was sold at higher prices. Chicago business was generally booked at 4.50c. and lead for Pittsburgh delivery was obtainable at 4.575@4.60c. The recent reduction in freight rates from the Rocky Mountain states while the rates from the Mississippi valley have remained constant has virtually cut off Missouri producers from any market except St. Louis and Chicago. Pittsburgh, for example, would normally be 33 points above the St. Louis market, that being equal to the freight rate, but it is now only 20 points above. A freight rate of 0.44c. from Omaha to the East, compared to 0.71c. from Herculaneum, Mo., is ridiculous, and the discrepancy will no doubt be remedied at an early date.

Consumers' business is reported to be improving, particularly the lead-pipe industry. Cable, battery, foil, and solder manufacturers are also using somewhat more lead than has been the case during the summer, and paint manufacturers are still running to capacity.

Zinc

An increased number of producers are out of the market at present prices. An occasional sale has been made through the week at 4.20c., but by far the larger volume of business has been done at the level which we quote. Yesterday and today there has been a slightly stronger tendency noted, and it would not be surprising to see the price advance slightly. Galvanizers are doing a better business, but continue to fill only their current requirements. Brass special and high-grade continue to be quoted at 10 points premium over Prime Western, and 6c. delivered, respectively.

Tin

With the exception of last Friday, the tin market has shown few signs of life. The tin-plate business is gradually improving, however, and buyers would be easily tempted by fractional

price concessions, which traders do not seem disposed to make. There is still but little 99 per cent grade on the market; in fact, it is practically all in the hands of one interest. More disposition has been evident lately to contract for forward delivery, and in some cases slight premiums have been asked over the prices for spot.

Arrivals of tin, in long tons: Sept. 13th, Liverpool, 25; 16th, Bremen, 25; 17th, Straits, 10; 19th, Rotterdam, 90; 20th, London, 25.

Gold

Gold in London: Sept. 15th, 111s. 6d.; 16th, 110s. 10d.; 19th, 110s. 3d.; 20th, 110s. 6d.; 21st, 110s. 7d.

General stock of money in the United States, Sept. 1: Gold coin, $3,377,417,980; standard silver dollars, $303,739,326; subsidiary silver, $272,366,584; United States notes, $346,681,016; Federal Reserve notes, $2,849,722,060; Federal Reserve Bank notes, $121,766,400; National Bank notes, $739,148,874; total, $8,010,842,240. The outstanding notes decreased $79,000,000 during August and the gold and silver coin increased $101,000,000. Money in circulation per capita, $52.41.

Foreign Exchange

Dealings in foreign exchange have been light during the last week, with the chief interest centering in the continued weakness of the German mark. On Tuesday, Sept. 20, francs were 7.0175c.; lire, 4.175c.; and marks, 0.92c. New York funds in Montreal, 11.14 per cent premium. Sterling cables were quoted at one-half cent premium over the demand figures given on page 515.

Silver

Advances in the price of silver in both New York and London occurred in the last week. Continued buying for the Indian bazaars and China account is responsible for the rise, and at the close the market appears steady. China exchanges have also improved as silver rose, which lends a good tone to the market.

Mexican Dollars—Sept. 15th, 49¾; 16th, 50; 17th, 50; 19th, 50⅛; 20th, 50⅛; 21st, 50½.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 18@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4.45@4.50c.; market dull. W.C.C. brand, 5.25c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb., black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $160@$170 per oz.

[1]**Molybdenum Metal** — In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominally, $52@$55 per oz.

Platinum—$72@$78 per oz., according to quantity.

Quicksilver—Market weaker at $42.50 @$43 per 75-lb. flask. Largely a jobbing business. San Francisco wires $43. Dull.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium** — Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $25@$27; ground, $28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—20@22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 50c. per lb. of contained sulphide, New York. Quotation purely nominal.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 17—Zinc blende, per ton, high, $22.90; basis 60 per cent zinc, premium and Prime Western, $21; fines and slimes, $19@$17; average settling price, all grades of zinc, $21.59.

Lead, high, $58.80; basis 80 per cent lead, $57.50@$58; average settling price, all grades of lead, $54.55 per ton.

Shipments for the week: Blende, 5,830; lead, 935 tons. Value, all ores the week, $176,890.

Larger demand again advanced zinc blende to $21 basis, over 5,000 tons commanding this price, with a tonnage around 1,700 selling on $20 basis. Lead ore was again advanced, this time to $57.50, with uncredited rumors of $58.

Purchases this week aggregated 6,750 tons, a gain of 3,100 tons over last week, and with the stronger demand the price level became more encouraging to sellers. Sellers were slow to accept the slight advance, expecting a still higher market.

Platteville, Wis., Sept. 17—No sales of lead or zinc ore. Shipments for the week none. Shipments for the year: Blende, 8,461; lead ore, 1,171. Shipped during week to separating plants, 334 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@ $2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@ $70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $23@$24 in bags, carload lots; (off-color) $21@$22 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5½c. per lb.; in bbls. 5¾c.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $25@$30, f.o.b., quoted at New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b., from New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; lump, $12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2½c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica — India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

[1]Foote Mineral Co., Philadelphia, Pa.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone — Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 13c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $30@$40; Canadian, $18@$40 per ton.

Mineral Products

Arsenic—5.75@6c. per lb.

Sodium Nitrate — $2.10@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $20@$25 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.20@$1.25 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11½c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $65@$67, f.o.b. furnace; resale, $90, delivered; English, $65@$67, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $25@$27, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.25 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $38@$40; 50 per cent, $60@$65; 75 per cent, $130@$135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 19.50c. per lb.; wire, 13.75c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 16.25c.; sheathing, 15.25c.; rods, ⅝ to 3 in., 13.25c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement — 40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000; $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Sept. 20, 1921

The advance in prices of wire products made a week ago is held, though on account of distributors having been covered for limited periods at the old prices, no rigid test has been applied. In sheets nearly all the independents have advanced prices $5 a ton. In pipe, on the other hand, new cards have been issued showing reductions from the July 7 card of $8 to $10 per ton, according to size, and oil-country goods have been reduced a shade more. The formal reduction is partly in recognition of shading in the last few weeks, so that the actual market has not declined so much. In bars, shapes, and plates ordinary sized orders go more readily at 1.65c., so that the declining tendency has continued. The decline in steel prices, as a general and continuous decline, appears to be over.

Prices do not seem to have had much influence on the volume of buying, except that there have been spurts in buying as consumers rushed to cover in anticipation of an advance.

Pig Iron—The market is quiet, prices being unchanged at $20 for bessemer, $19 for basic, and $21 for foundry, f. o. b. Valley furnaces.

Coke

Connellsville — Furnace, $3@$3.25; foundry, $4.25@$4.50.

MINING STOCKS

Week Ended September 17, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	47¼	45¾	47	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*52	*38	*39		
Allouez	Boston	19	19	19	Mar. '19	1.00
Anaconda	New York	38½	37⅞	38⅛	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2	1¾	1¾		
Ariz. Com'l.	Boston	8⅛	8⅛	8⅛	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*28	*22	*25		
Bingham Mines	Boston	11	10⅛	10⅜	Sept. '19, Q	.25
Calumet & Arizona	Poston	...	...	45½	June '21 Q	.50
Calumet & Hecla	Boston	239	230	238	June '20, Q	5.00
Canada Copper	N. Y. Curb	*36	*33	*33		
Centennial	Boston	8⅜	8⅜	8⅜	Dec. '18, SA	1.00
Cerro de Pasco	New York	27⅛	26	25⅛	Mar. '21, Q	.50
Chile Copper	New York	11⅛	10⅜	11		
Chino	New York	24⅛	23⅛	23⅛	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*18	*17½	*17½		
Con. Arizona	N. Y. Curb	*1	*1	*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	*1	*1	*1¼		
Copper Range	Boston	35	33⅛	34	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*36	*25	*27		
Davis-Daly	Boston	6⅜	6¼	6¼	Mar. '20, Q	.25
East Butte	Poston	9⅛	9¼	9¼	Dec. '19, A	.50
First National	Boston Curb	*55	*55	*55	Feb. '19, SA	.15
Franklin	Boston	2	1⅜	1⅜		
Gadsden Copper	N. Y. Curb	...	...	*25		
Granby Consol.	New York	19	18	18	May '19, Q	1.25
Greene-Cananea	New York	22	21	21	Nov. '20, Q	.50
Hancock	Boston	†3	†2½	2		
Howe Sound	N. Y. Curb	2⅜	2¼	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	34⅜	33⅜	34	Oct. '20, Q	1.00
Iron Cap	Boston Curb	...	...	5⅜	Sept. '20, K	.25
Isle Royale	Boston	19⅜	19¼	19¼	Sept. '19, SA	.50
Kennecott	New York	20⅜	19⅜	19⅞	Dec. '20, Q	.50
Keweenaw	Boston	†1	†*90	1		
Lake Copper	Boston	2⅜	2¼	2¼		
La Salle	Boston	†2½	†1⅜	1⅜		
Magma Chief	N. Y. Curb	*3	*3	*3		
Magma Copper	N. Y. Curb	*22	*20½	*21	Jan. '19, Q	.50
Majestic	Boston Curb	*8	*5	*8		
Mason Valley	Boston	2	1¾	1¾		
Mass Consolidated	Boston	1⅜	1⅜	1⅜	Nov. '17, Q	1.00
Miami Copper	New York	21⅞	21	21⅜	Aug. '21, Q	.50
Michigan	Boston	1⅜	1⅜	1⅜		
Mohawk	Boston	50	49	50	Nov. '20, Q	1.00
Mother Lode Con.	N. Y. Curb	4⅜	4⅜	4⅜		
Nevada Consol.	New York	11⅜	11	11⅛	Sept. '20, Q	.25
New Baltic	Boston Curb	...	...	3		
New Cornelia	Boston	14	13⅜	14	Aug. '20, K	.25
North Butte	Boston	10	9⅜	9⅞	Oct. '18, Q	.25
North Lake	Boston	†*50	†*25	*25		
Ohio Copper	N. Y. Curb	*6	*6	*6		
Old Dominion	Boston	23	22⅜	22⅜	Dec. '18, Q	1.00
Osceola	Boston	27½	25	25	June '20, Q	.50
Phelps Dodge	Open Mar.	†1.60	†1.45	....	July '21, Q	1.00
Quincy	Boston	38½	36	36	Mar. '20, Q	1.00
Ray Consolidated	New York	13½	12⅜	12⅞	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*20	*15	*20		
St. Mary's Min. Ld.	Boston	38⅛	36	36	June '20, K	2.00
Seneca Copper	Boston	...	...	13½		
Shannon	Boston	*99	*90	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	6⅜	6⅛	6⅛	Jan. '20, Q	.25
South Lake	Boston	†1⅛	†*50	1		
Superior & Boston	Boston	1⅜	1⅛	1⅛		
Tenn. C. & C. cfs.	New York	8⅜	8¼	8⅜	May '18, I	1.00
Tuolumne	Boston	*50	*46	*46	May '13,	.10
United Verde Ex.	Boston Curb	24⅜	23⅛	24⅛	May '21, Q	.25
Utah Consol.	Boston	3⅛	3⅛	3¼	Sept. '18,	.25
Utah Copper	New York	51⅛	49⅜	50	June '21 Q	.50
Utah Metal & T.	Boston	1⅞	1⅞	1⅞	Dec. '17,	.30
Victoria	Boston	1⅛	1⅛	1⅛		
Winona	Boston	*50	*45	*45		
Wolverine	Boston	12	11⅛	12		
NICKEL-COPPER						
Internat. Nickel	New York	14⅛	13⅜	14	Mar. '19,	.50
Internat. Nickel, pf.	New York	...	...	80	Aug. '21, Q	1.50
LEAD						
National Lead	New York	76⅛	74⅜	75	June '21, Q	1.50
National Lead, pfd.	New York	105	103	103	Sept. '21, Q	1.75
St. Joseph Lead	New York	11⅞	11⅜	11⅜	June '21, Q	.25
QUICKSILVER						
New Idria	Boston	†*50	....	*50		
ZINC						
Am. Z. L. & S.	New York	8⅛	8	8⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	27	25⅛	25⅛	Nov. '20, Q	1.50
Butte C. & Z.	New York	4⅛	4	4⅛	June '18,	.50
Butte & Superior	New York	14⅛	13⅛	14⅛	Sept. '20,	1.25
Callahan Zn-Ld.	New York	4¼	4	4	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	115⅛	115	115	Aug. '21, Q	2.00
Success	N. Y. Curb	...	...	2	July '16,	.03
Yellow Pine	Los Angeles	†*55	†*30	*55	Sept. '20, Q	.03

Stock	Exch	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Carson Hill	Boston	15⅛	14½	14½		
Cresson Consol. G.	N. Y. Curb	1 1/16	1 1/16	1 1/16	June '20, Q	$0.10
Dome Extension	Toronto	...	*65	*65		
Dome Mines	New York	17⅛	17	17⅛	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*44	*39	*40		
Golden Cycle	Colo. Springs	*67	*65	*67	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*6	*6	*6	Dec. '19,	.05
Hollinger Consol.	Toronto	7 42	7 35	7 41	Sept. '21, 4 wks.	.05
Homestake Mining	New York	...	...	55½	Aug. 21.	.25
Kirkland Lake	Toronto	*38	*34	35		
Lake Shore	Toronto	1 30	1 26	1 34	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1 95	1 93	1 95	Sept. '21, K	.05
Porcupine Crown	Toronto	*18	*16	*17	July '17,	.03
Porcupine V. N. T.	Toronto	*19	*16	*19		
Portland	Colo. Springs	*38	*38	*38	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	...	...	*4	May '19,	.05
Schumacher	Toronto	*23	*20	*23		
Silver Pick	N. Y. Curb	*10	*9	*10		
Teck Hughes	Toronto	*16	*15	15½		
Tom Reed	Los Angeles	*75	*72½	*73	Dec. '19,	.02
United Eastern	N. Y. Curb	2 1/16	2¼	2 1/16	July '21, Q	.15
Vindicator Consol.	Colo. Springs	*25	*25	*25	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*4	*3	*3		
Yukon Gold	N. Y. Curb	*95	*85	*95	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*21	*18	*18	Apr. '20, M	.03
Batopilas Mining	New York	⅛	⅛	⅛	Dec. '07, I	.12½
Beaver Consol.	Toronto	*27	*25	*26½	May '20, K	.03
Coniagas	Toronto	1.65	....	1.64	May '21, Q	.12½
Crown Reserve	Toronto	*11	*9½	*11	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3⅜	3⅜	3⅜	July '21, Q	.12½
La Rose	Toronto	*32	*27	*31	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*16½	....	*16½	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.00	1.14	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4½	4½	4½	July '21, Q	.15
Ontario Silver	New York	3½	3½	3½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	...	...	*11	Jan. '12,	.10
Temiskaming	Toronto	*25	*21	*24	Jan. '20, K	.04
Trethewey	Toronto	*12½	*10½	*12½	Jan. '19,	.05
GOLD AND SILVER						
Barnes-King	Butte	...	...	*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*75	*70	*74		
Cash Boy	N. Y. Curb	*4	*3	*4		
Consol. Virginia	San Francisco	*31	*30	*30		
Dolores Esperanza	N. Y. Curb	1 1/16	1 1/16	1 1/16		
El Salvador	N. Y. Curb	*19	*16	*16		
Jim Butler	N. Y. Curb	*7	*7	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*5	*3	*3	June '16,	.05
Louisiana Con.	N. Y. Curb	...	...	⅛		
MacNamara M.& M.	N. Y. Curb	*18	*14	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	....	....	4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅛	1 1/16	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*73	*65	*65		
Tonopah-Extension	N. Y. Curb	1 1/16	1 1/16	1 1/16	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅛	1 1/16	1⅛	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*90	*83	*83	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*7	*7	*7	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.07½	1.07½	1.07½	Dec. '21,	.15
Chief Consol.	Boston Curb	2⅛	2¼	2⅜	Aug. '21, Q	.05
Consol. M. & S.	Montreal	...	...	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†2.50	†1.30	....	July '20, Q	.10
Daly-West	Boston	†2½	†1¾	2¼	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	...	...	2	Apr. '21, K	.05
Electric Point	Spokane	*6½	*6	*6½	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*33	*29	*31		
Federal M. & S.	New York	....	....	7	Jan. '09,	1.50
Federal M. & S., pfd	New York	....	....	22½	Sept. '21, Q	1.00
Florence Silver	Spokane	*10	*10	*10	Apr. '19,	.01½
Grand Central	Salt Lake	†*31	†*12	....	June '20, K	.03
Hecla Mining	N. Y. Curb	4	4	4	June '21, Q	.08
Iron Blossom Con.	N. Y. Curb	*18	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00	†1.75	....	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	...	...	*3	June '21, I	.02
Prince Consol.	Salt Lake	*8⅛	*8	*8½	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*2	*2	*2	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*10	*8	*9		
South Hecla	Salt Lake	†*30	....	....	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	....	....	*8	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*3	*3	*3	Dec. '15	.05
Tamarack-Custer	Spokane	1.65	1.65	1.65	Jan. '21 K	.04
Tintic Standard	Salt Lake	1.97½	1.87½	1.87½	July '21, Q	.05
Utah Apex	Boston	2¼	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	....	*2	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	35	32¼	32½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	45	40	45	July '21, Q	1.50
Asbestos Corp., pfd.	Montreal	69	68	69	July '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	38⅛	36¼	36⅜	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	71	70⅛	70⅛	Sept. '21, Q	1.75
Am. Sm. pf. A	New York	68⅛	68	68	July '21, Q	1.50
U. S. Sm. R. & M.	New York	30⅛	29⅛	29⅛	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	New York	40	39	40	July. '21, Q	.87

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes ex.ra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

INDUSTRIAL NOTES

Exhibitors at Exposition of Chemical Industries Show Latest Improvements in Machinery and Processes

Few technical men who happened to be in the vicinity of New York City during the week beginning Sept. 12 failed to attend the Seventh National Exhibition of Chemical Industries at the mammoth Eighth Coast Artillery Armory. In addition, thousands of laymen were attracted to the various booths, which offered visual evidence of the rapid strides which this country has made in the manufacture of the many products into which chemistry plays a major part.

This year's show possibly did not contain as many novelties as that of last year, when much of the progress made during the war was exhibited, but it was no less interesting to one who attended for the first time. The site selected was thought by some to be too remote from the center of the city, being at the corner of Kingsbridge Road and Jerome Ave., but it could be reached within forty-five minutes from 42d St., and it is unlikely that the prospect of the ride discouraged many. The building is much better adapted to exhibition purposes than the Grand Central Palace, where last year's exhibition was held, for the ground floor is sufficiently large to house everything. Also, a suitable auditorium was available for showing the moving pictures and holding the technical meetings, which were featured this year more than has been the case before.

The moving pictures were selected from those prepared by the U. S. Bureau of Mines and various private companies engaged in the chemical field. They proved generally entertaining and gave a clear idea of how familiar articles are mined and manufactured, although some industries, such as the manufacture of dyes, do not lend themselves well to this method of explanation. About seventy reels were thrown on the screen in the six nights that the exhibition was open, the showing running from 7 to 10 o'clock each evening.

About four hundred manufacturers took advantage of the opportunity to advertise their products and meet possible buyers. Symposiums were held on Crushing, Grinding, and Pulverizing; on Evaporating and Drying; on Paint and Varnish; on Ceramics; on The Power Plant in the Chemical Industries; and on Dyes and Colors; together with many addresses on miscellaneous topics. A full report of the exposition activities will be made in the Sept. 28th issue of *Chemical and Metallurgical Engineering*. Some of the exhibits of interest to the mining fraternity will be briefly mentioned here though many others were equally attractive.

United Filters Corporation, New York City—The American Filter has now proved its usefulness in concentrating mills as well as in other more strictly chemical plants. Two models made the operation of this machine clear, the one-disk, 4-ft. model attracting especial attention. There was also a commercial-size unit of the Sweetland filter, and of the United filter press. A large view of the company's new home at Hazleton, Pa., formed an appropriate background.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—The principal feature of this exhibit was a small one-quarter size model of the Allis-Chalmers dust-collector in operation. This machine was also explained by a representative at the technical session on Tuesday afternoon. It should have many applications in removing dust from gases, and has some features not heretofore employed in baghouse processes. A sectional model of a rubber-lined sand pump also attracted attention.

The Duriron Co., Dayton, Ohio—The various products which can be advantageously made of Duriron formed the principal part of this exhibit.

The American La France Fire Engine Co., Elmira, New York—This company evidently does not make fire engines exclusively, for a varied collection of fire extinguishers, masks, and goggles was shown, which should have application in almost every mine, mill, and smelter.

Nash Engineering Co., So. Norwalk, Conn.—A new pump was exhibited in the Nash booth, which is destined to find much favor among mining engineers. Whereas the ordinary sump pump must be submerged and is difficult to get at, this invention makes the use of such a machine unnecessary. Two rotors are mounted on a single shaft, one sucking the water up for, say, a distance of fifteen feet, and the other acting as a centrifugal pump elevating to any distance required.

The Magnesia Association of America, Philadelphia, Pa.—Samples of insulation formed the large part of this exhibit. Eighty-five per cent magnesia is now well known, (the other 15 per cent is asbestos), and the benefits derived from covering heated pipes and furnaces with this material are evident with little study. A flow chart showing the various steps in the production of magnesia products and illustrating each with a sample proved informative.

The Dorr Co., New York City—Almost everyone has heard of Dorr classifiers, thickeners, pumps, and other metallurgical equipment. Working models of many of these were on view, and clearly showed the simplicity and efficiency of the methods used.

The Bristol Co., Waterbury, Conn.—The Bristol exhibit was confined to pressure and temperature gages and recording devices, and gave an excellent idea of the precision line of instruments which this company manufactures.

Oliver Continuous Filter Co., New York City—A small Oliver filter dewatering paper pulp was the object of much interest on the part of both technicians and laymen. This material proved particularly well adapted for exhibition purposes. A small, partially dismantled model of the standard portable Oliver filter, showing the copper screen and copper wire construction, was also on view. The installations of this filter are exceedingly numerous, as was evidenced by a map of the United States with each installation represented by a tag.

International Nickel Co., New York City—The exhibit of this company, which is the largest nickel interest in the world, was confined largely to samples of the various articles into which nickel and monel metal may enter with advantage. Cooking and household implements were especially interesting to the women present. Samples of raw materials were also on view.

Anaconda Copper Mining Co., Perth Amboy, N. J.—That the products of this company are not confined to copper was at once evident. Still, a great many different forms of manufactured copper were exhibited, including stamped roofing, cooking utensils, works of art, copper wire and cable, and other articles of general utility. Fertilizer, white lead, a large crystallized pot of tellurium and a mirror made of vitreous selenium, electrolytic silver, and various lead products were also on view. The large bar of gold shown was of doubtful origin.

Norwalk Iron Works Co., South Norwalk, Conn.—This company had on exhibit three compressors, including a new vertical three-stage oxygen compressor.

American Cyanamide Co., New York City—"Aero Brand" cyanide is now well known to American metallurgists as a result of its introduction into many mills where the high-grade product was formerly used. A large jarful was on view, together with "Ammo-Phos," a fertilizer which is the other chief product of this company.

General Chemical Co., New York City.—The General Chemical booths occupied the largest amount of space and were the most elaborate shown at the exhibition. The general appearance took one back to the age of Rameses. The subsidiary companies including the Solvay Process Co., the Barrett Co., and the National Analine & Chemical Co., were afforded ample opportunity to show their products.

Manhattan Rubber Manufacturing Co., Passaic, N. J.—The belts made by this firm, both for driving machinery and conveying material, are well and favorably known to most American millmen. A feature of the Manhattan exhibit showed the resistance to heat and moisture of a Condor belt which was running in water heated to 130 deg. F.

Lead Lined Iron Pipe Co., Wakefield, Mass.—Where fluids too corrosive for

iron pipe are to be handled, and still the strength of iron must be retained, lead-lined pipes and fittings such as were exhibited by this company are almost a necessity.

United Lead Co., Cincinnati, Ohio.—During the war, when tin was scarce, a process of electro-chemically hardening lead was devised, and samples of this product, known as Frary metal, were shown. A bell made of this metal was sufficiently hard to give an excellent ring, despite the fact that the metal contains 98 per cent of lead. Many other lead products were also shown in this exhibit.

Dings Magnetic Separator Co., Milwaukee, Wis. — Two small working models of the Dings Magnetic Separator were featured. Some of the numerous products which may be separated by this process were also exhibited in a case.

Roessler-Hasslacher Chemical Co., New York City.—Some of the chemical products which are manufactured by this firm were exhibited in numerous jars.

Nichols Copper Co., New York City.—One of the most attractive features of the exhibits was afforded by a large pedestal formed of crystallized copper sulphate, supporting models of fruits and vegetables, in the growing of which this substance is universally used as an insecticide. Some of the rougher products of this company, such as copper wire bars and ingots, were also on view.

Taylor Instrument Co., Rochester, N. Y.—Samples of all of the instruments made by this company would no doubt occupy half the floor, but some of the more important found a place in the booth.

The Merrill Co., San Francisco, Cal.—The principal feature of the Merrill exhibit was the Merrco valve, which was exemplified in several forms and which is now well known to metallurgists.

The S. Obermayer Co., Pittsburgh, Pa.—This company manufactures the Hot-Patch furnace cement, and a small electric furnace was installed to show the applications of this material.

Coors Porcelain Co., Golden, Col.—American chemists are no longer dependent upon German porcelain, as was evidenced by the varied forms of laboratory porcelain which were exhibited by this company, and all of which were made in Colorado.

General Electric Co., Schenectady, N. Y.—An automatic arc-welding outfit and a 50-lb. brass-melting furnace were featured in the large exhibit of this company.

Bausch & Lomb Optical Co., Rochester, N. Y.—The booth occupied by this firm was taken up with samples of microscopes and various other optical instruments.

Raymond Brothers Impact Pulverizer Co., Chicago, Ill.—The Raymond exhibit included a one-quarter size model of the Raymond No. 1 automatic pulverizer, with automatic throw-out; a one-quarter size model of the Raymond air-separating plant, for grading and classifying finely ground materials; a one-quarter size Raymond High-Side four-roller miller for the fine grinding of lime, limestone, coal, phosphate rock, clays, talc, and like substances; and a full size Raymond No. 0000 pulverizer for grinding colors, clays, and similar materials. These were all working models.

Stimpson Equipment Co., Salt Lake City Utah.—Mining engineers were particularly interested in the Stimpson exhibit, inasmuch as two models of the new Mitchell crusher were on view, as well as a small Mitchell vibrating screen and a section of one of the vibrators. The Mitchell crusher is of the gyratory type, but the vertical shaft contains an electric vibrating unit which gives a much greater capacity than is obtained in the older forms. Lower power requirements and a more evenly sized product are also secured. This machine would seem to have great possibilities, and, although not yet on the market, it is understood that it is to be actively pushed in 1922.

The Lunkenheimer Co., Cincinnati, Ohio—Valves and oil-feeding devices formed the major part of the Lunkenheimer exhibit.

Sullivan Machinery Co., Chicago, Ill.—A feature of the Sullivan booth was a model of air-lift pumping equipment manufactured by this firm.

Morse Chain Co., Ithaca, N. Y.—Machinery models in actual operation always attract attention, and the silent chain drive exhibited by this company was no exception.

Yale & Towne Manufacturing Co., Stamford, Conn.—Although this company is famous chiefly for locks, it manufactures many other kinds of equipment. A portable crane mounted on an electric truck was featured. The exhibit also included several models of chain blocks.

Hardinge Co., New York City—A new type of the Hardinge conical mill was exhibited in a commercial size, 5 ft. x 22 in. The discharge opening is much enlarged, allowing a larger circulating load to be carried than in mills of the older design as well as securing a larger tonnage ground per unit of power. The familiar glass model using nuts instead of steel balls was also on view for those who were not familiar with the action of this mill.

W. S. Tyler Co., Cleveland, Ohio—The screening apparatus made by the Tyler company has a world-wide reputation. The Hum-mer electrically vibrated screen attracted a great deal of attention. It has now been on the market for two or three years, and has proved greatly superior to older designs.

Huff Electrostatic Separator Co., Arlington, Mass.—A working model of the Huff separator was on view and attracted much interest, as it did last year. The machine has many applications in removing impurities from certain types of ores.

M. W. Kellogg Co., Inc., New York City—The Kellogg exhibit consisted of a few forge-welded Chemi-Steel products.

Blaw-Knox Co., Pittsburgh, Pa.—A sectional steel building formed the centerpiece of the Blaw-Knox booth, but the small models of grab buckets picking up sand aroused the most interest. Some of the ladies expressed the opinion that they would make ideal toys for small boys.

Ruggles Coles Engineering Co., New York City.—A small brass and mica model of the familiar Ruggles Coles drier was a feature of this exhibit.

William Ainsworth & Sons, Denver, Col.—Three of the latest forms of balances for laboratory use were on view in this booth.

Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.—A model steam turbine for driving pumps, fans, and like machinery was the *pièce de resistance* of the Westinghouse exhibit, although one or two motors and a bakelite-micarta airplane propeller were also on view.

Baker & Co., Inc., Newark, N. J.—Rare metals and some of the products in which they are used formed the basis of the Baker exhibit.

Wedge Mechanical Furnace Co., Philadelphia, Pa.—A small model of the Wedge roasting furnace was included in the exhibit of the Pennsylvania Salt Manufacturing Co. This furnace has received general application for roasting concentrates for feeding to reverberatory furnaces.

British America Nickel Corporation, Ltd., Ottawa, Ont.—Although the mining operations of this company are now suspended, it was evident that it is still an active organization. A large tube of nickel, possibly two feet in diameter and fifteen or twenty feet long, attracted much attention.

Kennedy Valve Mfg. Co., Elmira, N. Y.—The valves and fittings manufactured by this company were well exemplified in their exhibit.

Canadian Pacific Railway Co., Montreal, Que.—The immense illuminated map of Canada showing all railways and mineral districts by miniature incandescent lights proved as interesting to the crowds as in former exhibits. It is a remarkably effective method of showing the situation and accessibility of a nation's resources, a switchboard making it possible to illuminate only those industries in which the onlooker is interested.

Dominion of Canada, Ottawa, Ont.—The Canadian government exhibit was a large one and showed the numerous resources in lands, forests and mines of our northern neighbor to good effect. Samples of a large number of raw materials and finished products were on view, and much statistical information was available for those interested.